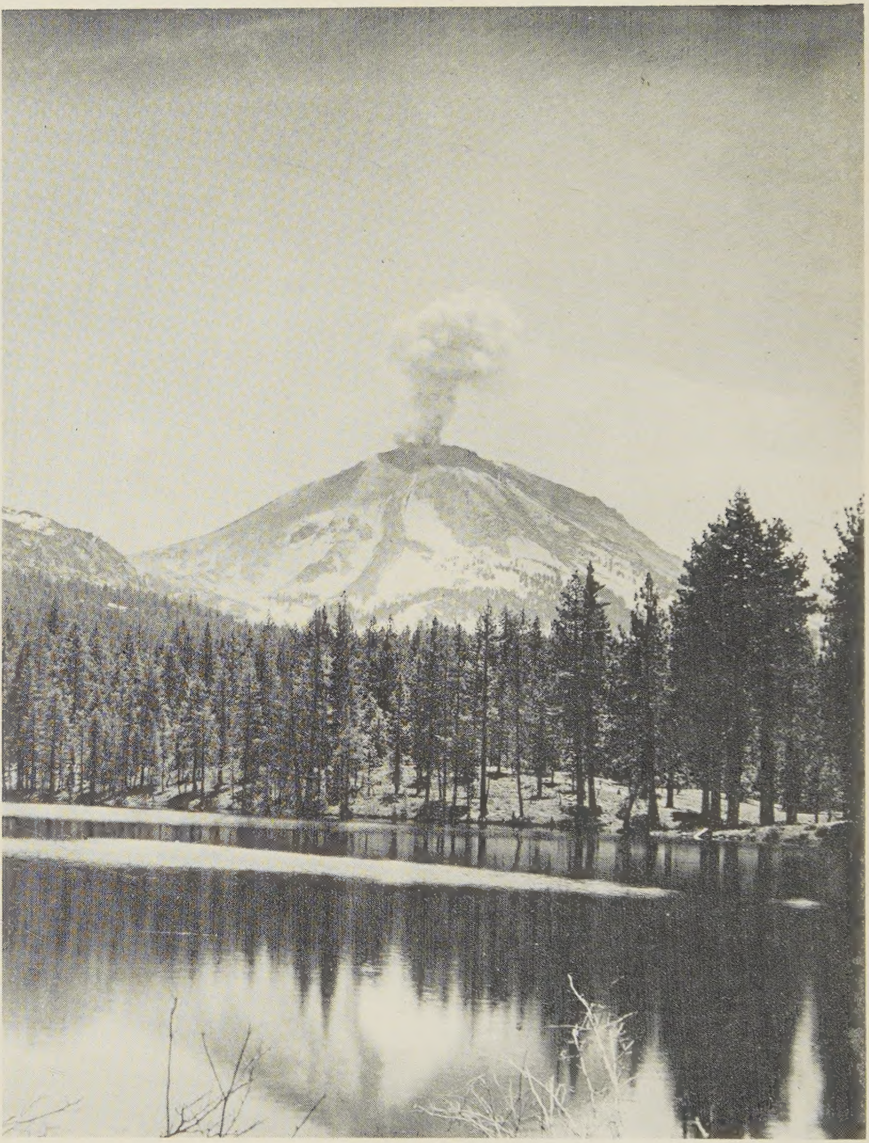
ERUPTIONS of Lassen Peak



Lassen Peak in mild eruption, viewed from Reflection Lake

PICTORIAL HISTORY
OF THE
LASSEN VOLCANO

By

B. F. LOOMIS

Published in cooperation with the
National Park Service

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PREFACE

My reason for writing about the Lassen Volcano at this time is that there is need for such a work. Need, because there are many persons visiting the park who have heard but little about the volcano, and perhaps that little wrong. They all ask many questions about the volcano, and they hear various stories from different parties, and as there is so much that needs to be said about the volcano that the tourist goes away with only a vague idea of what has occurred even though he may have visited every section of the Lassen Volcanic National Park.

So far as I know, there are at present no books on sale around the park that will furnish the sightseer with the information desired. And as I have a fund of first-hand information, and a large number of photographs, I feel that it is a duty I owe to the inquiring public to write a book in a clear and truthful manner which will answer a great number of the questions which the sightseer wants to know. It will be my aim, therefore, to tell what I know about the volcanic activity around the Lassen Peak region and then illustrate it with photographs. This, I believe, will give the sightseer a clearer idea of what has occurred than could be done in any other way.

Some people tell me that we should not tell all we know about the Lassen Volcano, for it will scare people away. That may be true in a few isolated cases, but on the other hand, if we should misrepresent it and say that it was less than it really is, there would be as many others who would pass it up and think it not worth while to visit the Lassen park at all. Therefore I propose to tell things exactly as they are as nearly as possible, although there are many things that might be said about the volcano that are difficult to describe, they must be seen to be fully appreciated.

In 1914, during the period of Lassen's greatest activity, I climbed to the top of Lassen Peak six times that summer taking pictures, and while I realized that if the mountain should blow off while I was looking into the yawning chasm and taking pictures of the crater, I would not be here to tell the tale. But for all that I never experienced the feeling of fear. For I was there to take pictures, and the pictures were the principal object of my thoughts. But now, when the volcano has subsided into quiescence, I can see no reason why any one should be in any danger of visiting the Lassen Peak region, or of looking into the crater, for there is no likelihood of an explosive eruption at this time.

I am indebted, first of all, to Professor J. S. Diller, of the United States Geological Survey, and also to Dr. Arthur L. Day, of the Geophysical Laboratory at Washington, D.C. I accompanied Professor Diller on several occasions in his visits to the Lassen Peak region, and he made his home with us when on our side of the mountain. Dr. Day also made his home with us on one of his visits to the Lassen Peak region.

Drs. Arthur L. Day and E. T. Allen have written an elaborate book on "The Volcanic Activity and Hot Springs of Lassen Peak." And, while their work is designed for the scientific, it will also be enjoyed by the lay reader. The book is published by the Carnegie Institute of Washington, D.C.

Professor Diller has written several brief histories and bulletins on the geological studies around the Lassen Peak region, while Dr. Day and E. T. Allen, the physical and chemical phenomena.

We are indebted to the Forest Service in reporting the many outbreaks of Lassen Peak; for without their aid we would not know when the eruptions occurred, since Lassen Peak cannot be seen from Viola on account of the forest trees. Their telephone calls were of very great assistance.

We are also indebted to Mr. M. E. Dittmar, "Father of the Lassen Park." It was Mr. Dittmar who got up a petition and sent it to Hon. John E. Raker, asking him to introduce a bill in Congress for the establishment of the Lassen National Park. Mr. Dittmar has worked harder than all the rest of us put together to get the park established, and to get appropriations for its maintenance and development. During his four years' advertising campaign as Secretary-Manager of the Lassen Volcanic National Park Association, he and I have been closely associated and to our mutual benefit.

We are also indebted to our many friend photographers who have loaned us their photographs for this work. Credit will be duly acknowledged for them in the body of the work.

B. F. Loomis—1926

INTRODUCTION

Lassen Peak is named after Peter Lassen, the sturdy pioneer, who used the snow-capped peak as a landmark in guiding emigrants over the mountains to the Sacramento Valley. The old pioneer is buried in a lonely grave in Susanville, Lassen County. An attractively designed monument fifty miles from the peak marks his final resting place, but the greater and more enduring monument is the mountain that bears his name.

In the days of the Arguello expedition in 1821, the Spanish called the peak St. Joseph's Mountain. The names Lassen's Peak and Lassen's Butte came into general use soon after 1850. In later years the possessive form of the name was dropped.

If we look up the early history of Lassen's latest volcanic activity, we find that it was usually called "Mount Lassen." In fact, I hardly ever heard it called Lassen Peak until Professor Diller came on the scene and insisted that we call the mountain by its geographical name—Lassen Peak. So in quoting some of the early newspaper accounts of Lassen's activity in which Mount Lassen is used instead of the proper name, I have copied verbatim, but in my own writing, I always use the proper name—Lassen Peak.

In writing this work on the Lassen Volcano, we will consider the subject chiefly from the phenomenal standpoint; and anything aside from this we need but merely mention; while the larger work I will leave to another author who will some day, I presume, write a history of the Lassen Volcanic National Park.

(NOTE: While most of the author's original observations and theories have been left in the text, corrections of scientific fact have been introduced by means of footnotes. All photos are by the author except where noted otherwise).

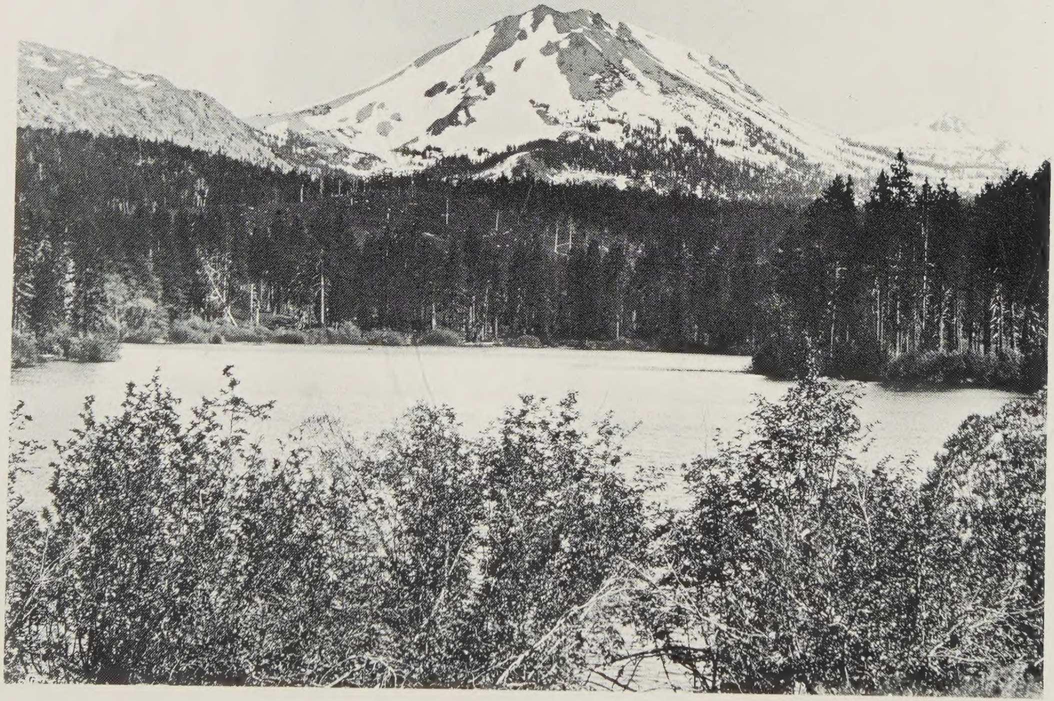

Fig. 1. Telephoto view of Lassen Peak, viewed from Manzanita Lake in 1900 before any eruptions occurred. A portion of Chaos Crags is seen at the left, and Eagle Peak is at the right.

LASSEN PEAK ERUPTS

It was on Memorial Day, May 30, 1914, that Lassen Peak broke out into an active volcano.

This was not the first time that Lassen Peak was an active volcano, for the old crater at the top of the mountain indicates that in ages past this old peak had thrown out fire[1] and smoke[2] and lava, filling the country with debris for miles around.

Nor was Lassen Peak alone in this; for all that group of mountains has been thrown up by volcanic action. The first of these was farther west. Mt. Tehama, of which Brokeoff Mountain forms the western rim, was the original volcano, the northwestern wall of which is washed away into Hollingsworth Flat, more recently called "Brokeoff Meadows." Next came Lassen Peak, and later still, those craggy peaks north of Lassen, recently called Chaos Crags. There are two saucer craters at the south end of these crags, and a large crater three hundred feet deep at their north end, to show where the last eruptions occurred. More recent still is Cinder Cone, 10 miles northeast of Lassen, a cinder mound 700 feet high above the surrounding plain, with a crater in its top, and a huge mass of rocks a hundred feet deep or so extending south and east from the cone. These lava rocks there show all the colors of the rainbow, and where the rocks for a mile or more toward the south are crumbling away from erosion[3] forms a rainbow colored sand which is very beautiful to behold. Many other hills within sight of Lassen have saucers[4] in their tops showing that they were volcanoes in ages past. In fact, we are informed by Professor J. S. Diller, of the U. S. Geological Survey, that we have here the largest volcanic area in the world, extending north into Alaska, and east to the Yellowstone National Park.

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[1] Fire as such is not normally produced in any appreciable amount in volcanic eruptions. The glow is the reflection from yellow or red-hot lavas on the fume cloud above. Volcanic gases mixing with the oxygen of the air are sometimes ignited by the heat from the molten lava, however.

[2] Smoke is not the smoke we normally think of as the result of burning. Instead it is composed of steam, sulfurous vapors, clouds of fine volcanic ejecta known as ash or any combination of these. A more correct term is fume.

[3] —and decomposition by hot steam and sulfurous fumes

[4] "Craters" would be a more accurate word

Saturday, May 30, 1914. The first outbreak of the volcano occurred at 5 p.m. This was witnessed by Bert McKensie, of Chester, who was looking directly at it when it occurred. Forest Ranger Harvey Abbey investigated it Sunday, May 31.

Forest Supervisor Rushing sent the following report to the Courier Free Press at Redding:

> Mt. Lassen is in eruption from a new crater on the north slope close to the summit. The new crater is 25 feet wide, and 44 feet long, with deep fissures radiating in all directions. Lava and ashes shot up from the depths cover an area 200 feet in diameter, to a depth varying from a foot to two feet. The new volcano is in eruption today, greater volumes of smoke and steam arising above the old sentinel peak than yesterday.

The Forest Service lines connect at Viola, so we received a telephone Saturday evening, and the next day, Sunday, several parties, including myself, went to Manzanita Lake. My letter to the Courier Free Press is in part as follows:

> VIOLA, June 1. At about 4:30 last Saturday afternoon Mount Lassen was seen to belch out a huge mass of smoke. There is a basin or crater in the top of the mountain and there is where the eruption took place. The next day, Sunday, the mountain was still smoking, but not so much as was seen the day before. Then again this Monday morning at about 8 o'clock another cloud of smoke went up, something like an explosion, or puff, and since then Mount Lassen has been a genuine active volcano.
>
> The smoke may be seen from all over the country; from Mineral, Viola, Lost Camp, Hat Creek, and in fact, if the weather were clear, we do not see any reason why it cannot be seen from all over the Sacramento Valley, wherever the mountain is visible, since the volume of smoke is sufficient to be seen at long range. * * * This last blowout which occurred this (Monday) morning, undoubtedly made the rent much larger. Mud seems to have been the principal thing blown out, so Mr. Abbey reports, and some of this has rolled down the side of the mountain which has made the snow black in some places. Two photographs, one taken yesterday and the other today, show that the snow was much darker today than it was yesterday, as the wind blew the smoke down the side of the mountain, and the smoke has darkened the snow in the direction followed by the smoke.

A party from Viola went up to Manzanita Lake yesterday, (Sunday) and again today to take a peep at the mountain and get some photographs. Yesterday the wind was blowing the smoke away so it could not be seen to any advantage from the lake; but today the wind was from the southwest which blew the smoke down the northeast side of the mountain so we had a fine view of it. But the smoke in white clouds, while plainly seen with the eye does not show up well in a photograph, and it is so in this case. Our picture, which accompanies this letter, shows the darkened snow itself blends in with the sky along the divide between Lassen Peak and Chaos Crags, so it is not very plainly seen in the picture.

My letter to the Courier Free Press under date of June 5, follows:

A party from Viola went to the top of Lassen Peak yesterday, (Thursday, June 4) to get some pictures of the crater, Clarence Kimball accompanied me. We had heard that a moving picture outfit was on the way up there, so we thought this a good time to go. We went as far as Manzanita Lake with an auto, and from there we took the trail on foot. On the north side of Lassen Peak we found some red snow. Considerable red snow is to be found on the west side of the

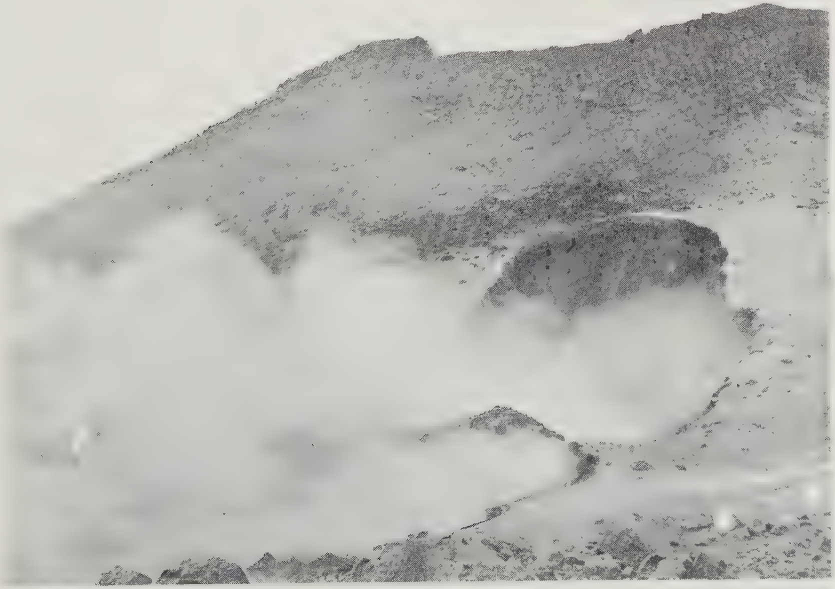

Fig. 2. New Crater in the top of Lassen Peak, June 4, 1914.

Peak. Red snow is to be found in only a few places in the United States—on Mount Shasta, Mount Hood, and possibly a few other places[5]. It is quite common in the Arctic regions however. The red color is due to a small animalcule[6] that lives in the snow, which gives the snow a blood red color.

It took us about an hour and a half to reach the top of the divide between Lassen Peak and Chaos Crags, and about two hours to climb from there to the top of the Peak, a distance of perhaps three fourths of a mile but the climb is very steep and difficult.

When we reached the top of the mountain we found eight other men there taking pictures for the newspapers. A Chronicle staff artist, but no moving picture outfit was there. The weather was cloudy, and before we left a dense fog settled down on the top of the mountain. This interfered with our picture taking, to some extent, but we had made three exposures before the fog appeared, and one of these was very choice.

The original Crater in the top of Lassen Peak is something more than a quarter of a mile across, with four high hills around the border on the old crater rim. On the south side is a bank of snow ten or fifteen feet deep, a hundred yards across either way, and below is a pond of water at the bottom of the old crater. This pond is frozen over; but neither the pond of water or the bank of snow is much discolored as yet from the recent eruptions.

The new crater is north of the pond of water about a hundred yards, being well to the north side of the original crater. The hole recently blown out is perhaps 150 feet long by forty feet wide in the widest place, while in the narrowest places it is only a few feet wide. This gives the appearance of being three holes, yet these are all connected to some extent. (Fig. 2).

The smoke had died down at the time when we were there, so it could not be seen from the valley below on the west side, as what little smoke there was was going toward the southeast. Only the evening before, however, it presented a fine view from the Viola section.

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[5] Red snow may be found throughout the western United States where snow patches remain in summer at high elevations.

[6] The red color is caused by microscopic plants called algae.

> All the rocks and mud[7] thrown out of the new crater landed inside the original crater rim a short distance below, south from where the recent hole has been blown out. Some steam and sulphur fumes were coming out of the hole, and our picture, which accompanies this letter, gives a very clear impression of it.
>
> On the sides of the Peak the ashes[8] have settled on the snow, rendering it very dark in places, and in some places it is quite black, so that the snow cannot be seen. Near the crater the ashes are half bootleg deep, but after we got over to the side of the mountain we did not see any places where it was more than about half an inch deep. The ashes are a blue-grey color, almost like Portland cement in fineness and appearance when dry, but they turn to almost black when wet.

On June 9, having heard that Lassen Peak had another eruption the evening before (Monday) at 4:30, a party of three—G. R. Milford, J. A. Newton and myself—went to Lassen to get some pictures. We had just had a good rain with light snow two days before, but it was mostly gone even on the high mountains. With plenty of nails in our shoes to keep from slipping, we found it better walking on the snow than the rocky ground.

It was our intention to go to the top of the mountain to get some views of the crater, as the steam was coming out much more abundantly than formerly. It seemed to be increasing in volume all the time.

When we reached the top of the divide between Lassen Peak and Chaos Crags, we stopped to take a few pictures of the steam clouds that were coming out of the crater, and from here also we had a good view of the mountain at close range. This done, we were just getting ready to start on for the final climb up the mountain side when Mr. Milford said he heard or felt a slight rumbling, and looking up, he shouted, "Look there."

On looking up we saw huge columns of smoke ascending from the crater. They ascended probably 500 feet above the mountain and then drifted away in the direction of the wind toward the east. The sight was

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[7] Mud is not thrown out of a volcanic vent. Mud flows are normally a secondary result of an eruption. Volcanic heat is too great to allow water to exist in the liquid state.

[8] The ashes referred to are more properly termed "volcanic ash." The material is not the result of any combustion, but rather coarse or fine fragments of lava which have been shattered to bits by explosive forces.

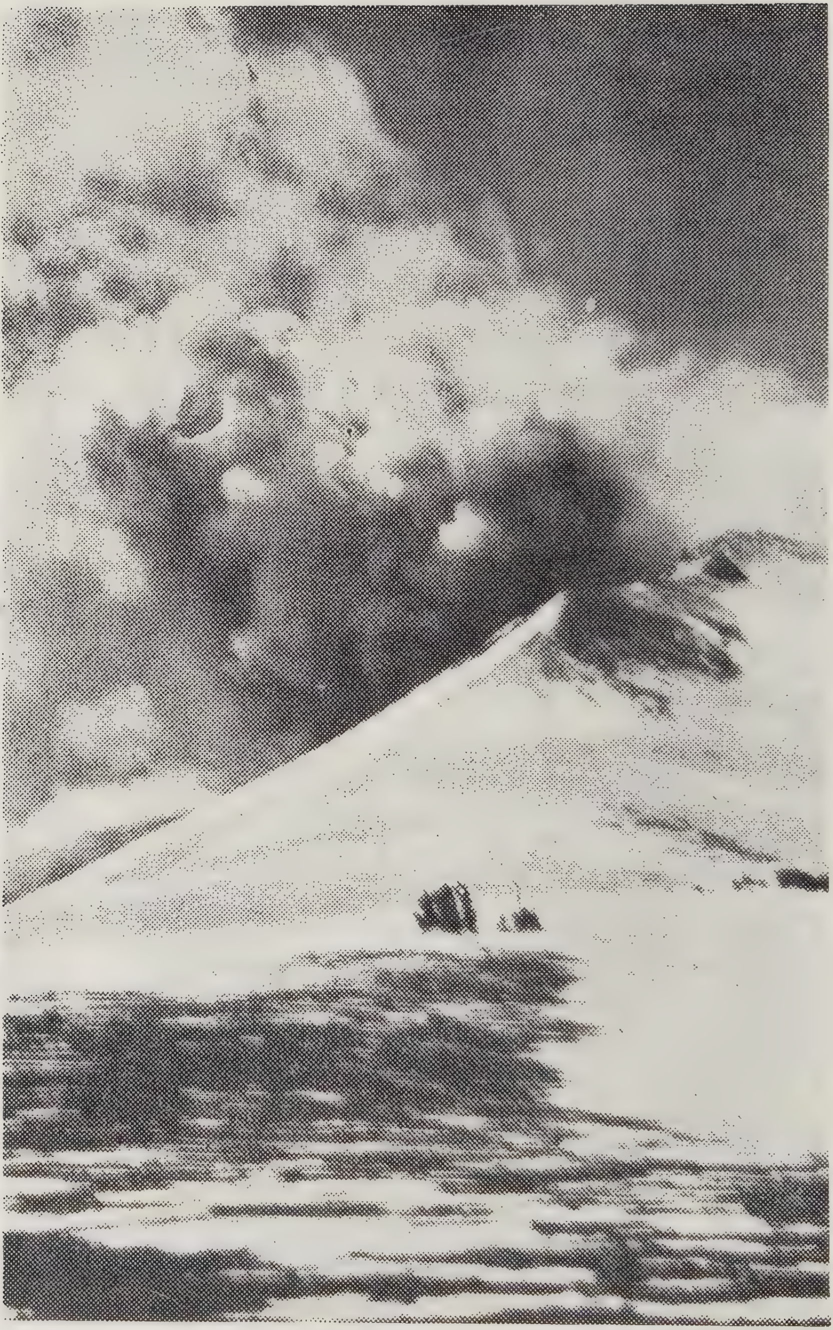

Fig. 3a. Lassen in eruption June 9, 1914, the first eruption picture published. Photo by G. R. Milford.

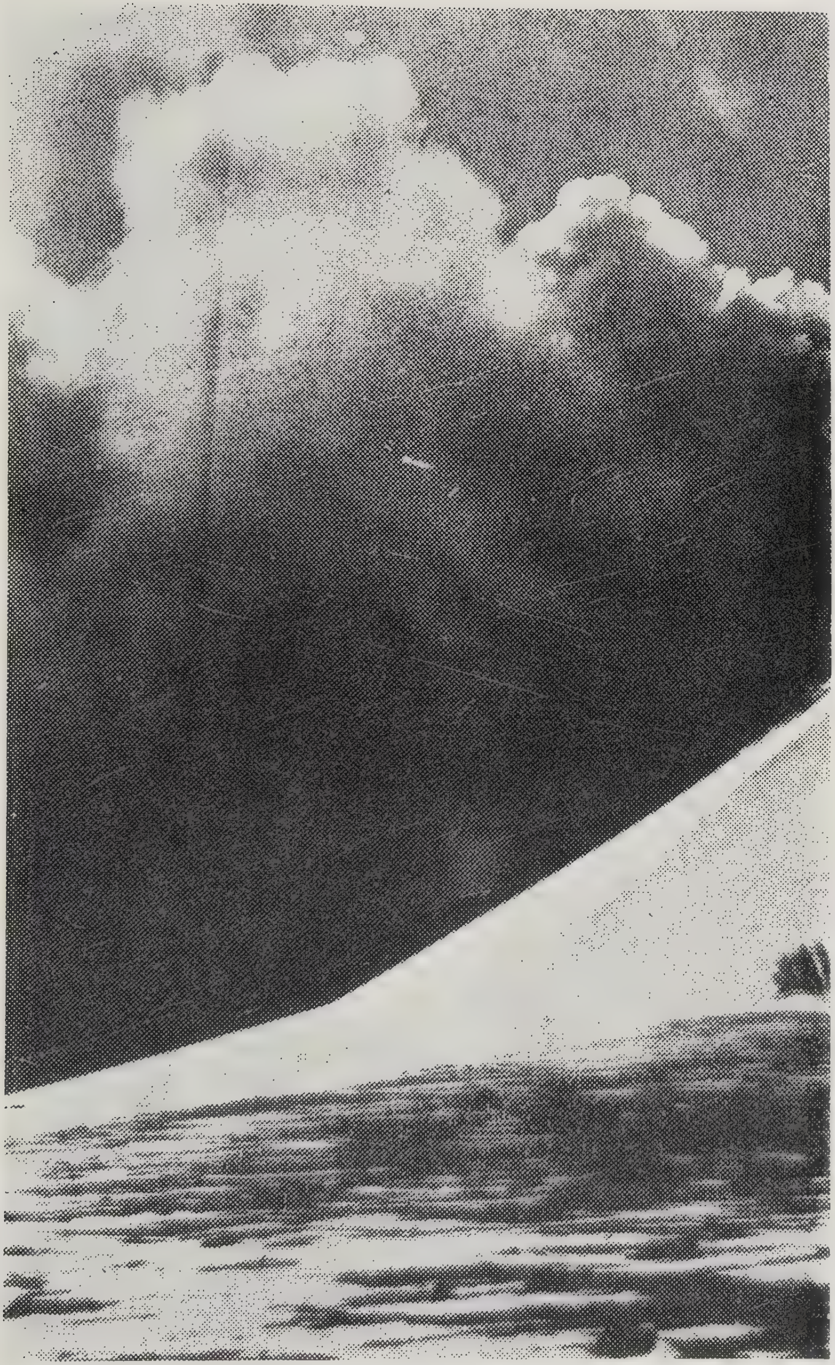

Fig. 3b. Eruption June 9, 1914. Photo by G. R. Milford.

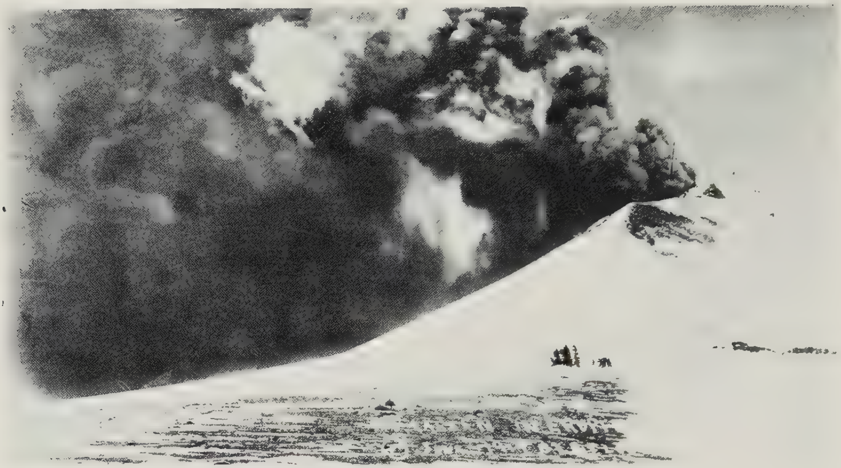

Fig. 4. Lassen in eruption, June 9, 1914, viewed from the divide between Chaos Crags and Lassen Peak.

fearfully grand. The huge clouds of black smoke ascending while the borders were lined with innumerable curls of sunlit crests which seemed so dense that apparently we could not see into them an inch. On the underside of the column of smoke the ashes were falling in streaks toward the ground—falling slowly like snow or hail.

To say that we were excited is putting it mildly. We all began talking or shouting at once, and in our haste to get some pictures of it, I spoiled a plate or two by not focusing properly. Then discovering the error, I took another view, pointing the camera up as high as the traffic would bear, then I got my first good picture of a volcano in eruption. (Fig. 4).

On this occasion the eruption lasted for about half an hour, while on former occasions they were usually over in a few minutes. These eruptions seemed to be getting more voluminous with each recurrence, and in writing to the Courier Free Press I ventured the opinion that if these continued to increase, we may look for something serious later on.

In about half an hour the volcano was sending out only steam clouds in about the same volume as it was before this eruption began. It seemed queer to us that the volcano should so soon subside into mild eruption again after sending out such large volumes of black smoke.

Our pictures made, we beat it for Viola. Then Mr. Milford hit the high places in the road toward Redding. On reaching Redding, he had his films developed and soon his pictures were speeding on the way to some newspapers. His series of five pictures were published in The San Francisco Examiner, and these, I believe, were the first pictures of the

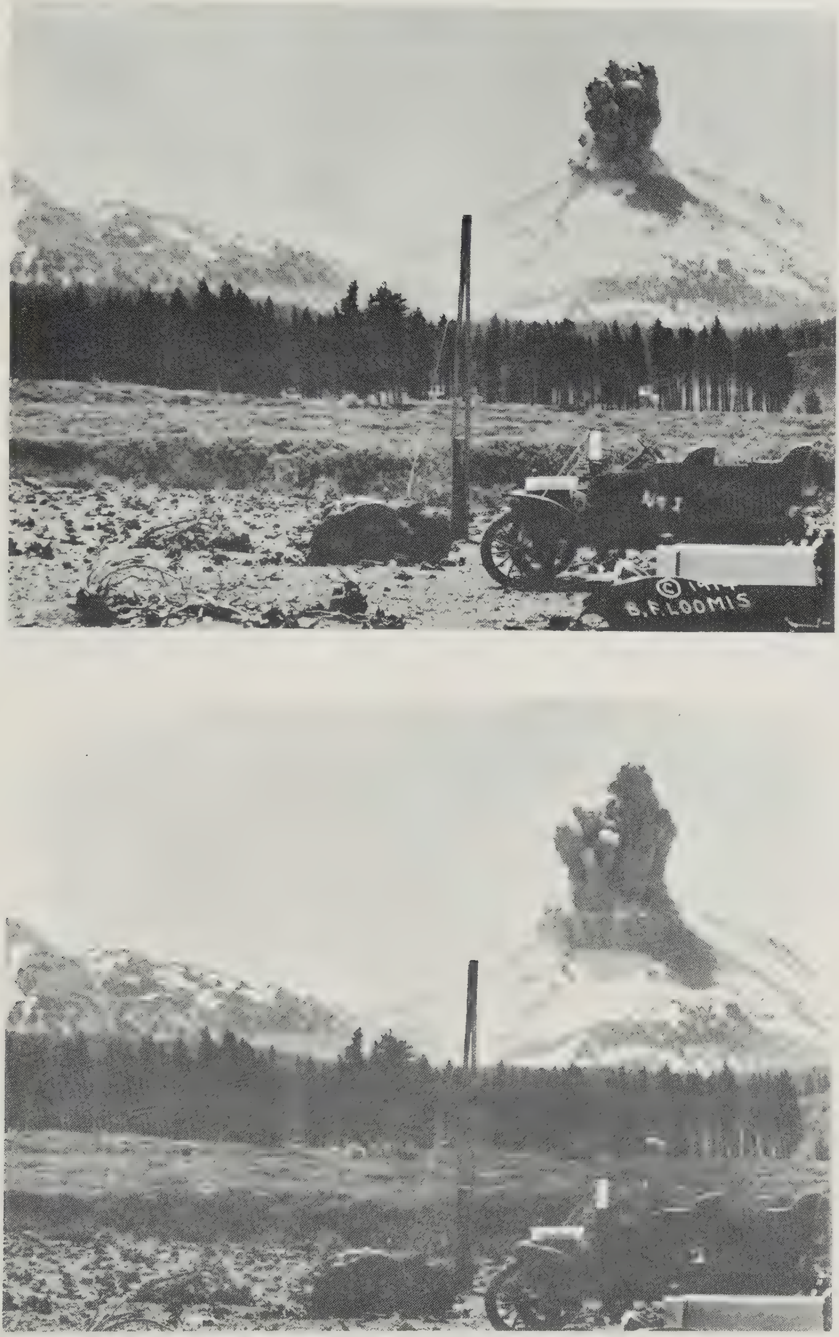

Fig. 5. Six successive views of the eruption of June 14, 1914.
(Continued on Pages 20 and 21).

© 1914
R.E. LOOMIS
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volcano that were published (Fig. 3). My picture was a good one, but the mails at Viola were slow, and for this reason my picture received no attention.

Then the idea occurred to me that I should get a series of pictures, all of one eruption, which would show the progress of the eruption from beginning to end. Accordingly, we selected a place by the side of the road in the manzanita thicket, a short distance west from Manzanita Lake. What followed is best expressed in a letter which I wrote to the University of California in answer to an inquiry about the particulars of this eruption, under date of July 13, 1924:

> Mr. B. S. Holway, Berkeley, California.
>
> Dear Sir:—Yours of the 3rd inst. is just received, in which you ask me to say a few words in regard to the eruption of Mt. Lassen. It affords me pleasure to comply with your request, as I know the information will be used for educational purposes.
>
> Viola is situated about ten miles west of Mt. Lassen, and as I have climbed to the top of Mt. Lassen three times since the first eruption on May 30, I am fairly familiar with the conditions as they exist there.
>
> We had been camped on the road two days, Mrs. Loomis and I, waiting for an eruption to occur, with the camera focused and trained on the mountain all ready to begin taking pictures at a moment's notice. Mrs. Loomis enjoys landscape painting, and to get the colors properly it was necessary for her to witness an eruption. At about 9:45 Sunday morning, June 14, our vigilance was rewarded with success. (Fig. 5). I saw the smoke ascending from the crater the moment the eruption began. I ran to the camera, put in a plate holder and exposed, getting what we call photo No. 1. Then I changed the plate holder and exposed again as quickly as possible, getting photo No. 2. At this time a wonderful phenomena occurred. The heavy ashes contained in the column of smoke, its momentum being spent, began falling down and flowing down the sides of the mountain, then rolling up in immense clouds of black smoke. This is slightly noticeable in photo No. 2. At this juncture I exposed again, getting photo No. 3. The wind was from the southwest which blew the smoke to the left from my position and away from the top of the peak; then another cloud shot upward, when I exposed again, getting photo No. 4. These clouds of

black smoke were so dense that they seemed to stand up like a mountain of granite in a solid mass. The sight was fearfully grand. The cloud was moving rapidly toward the north, when I soon got No. 5. These five photos were taken with a telephoto lens, 14 inch focus, and later, when the cloud of smoke was all spread out, I got photo No. 6, this being made with the combined lens with 8½ inch focus, and the size of the plate being 6½ x 8½.

This eruption of June 14th was the eleventh eruption, and the time between photos No. 1 and No. 6 was about twenty minutes. These eruptions sometimes appear as a puff of smoke and ashes, and at other times they continue for about half an hour. The distance from my view point to the top of Lassen Peak is a trifle over six miles.

But in the midst of my enthusiasm in making the pictures I could not help thinking of those men who I knew must be near the mountain. Were they safe? Mr. R. E. Phelps and his mill crew, ten men in all, were camped at Manzanita Lake the night before. They struck camp early in the morn-

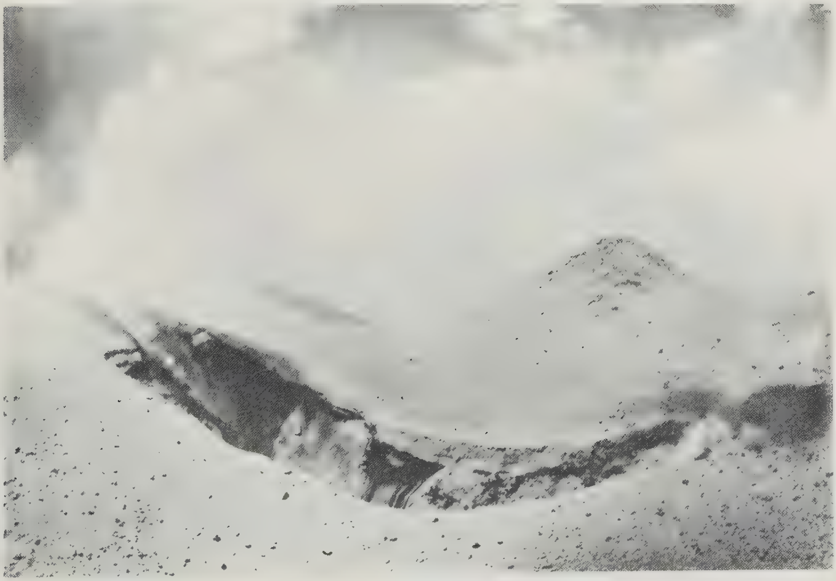


Fig. 6. Crater of Lassen Peak, June 20, 1914, looking North. Notice the snow in the foreground is black from volcanic ash, and covered with rocks, indicating the rocks were cold when thrown from the crater. Notice steam coming from west end of crater. The light streak below the snow is the bottom of the old crater, and terminates in the western notch at the lower left corner of the picture, through which the new lava ran after the great eruptions of May, 1915.

ing to climb the mountain to look at the crater. They went up on the north side right under where the heaviest smoke and ashes fell. Another party of five men also left the lake at 8 o'clock on the same mission. Mr. Phelps' party had just reached the rim of the old crater and sat down to rest a short time, watching the smoke from the crater when the eruption began. Without any warning, or explosion that could be heard, a huge column of black smoke shot upward with a a roar, such as would be caused by a rushing mighty wind, and in an instant the air was filled with smoke, ashes and flying rocks from the crater. They all ran for their lives. Mr. Phelps hid under an overhanging rock, which sheltered him from the rocks which brushed past him as they fell. Lance Graham was a few feet away when he was struck by a flying rock, which cut a great gash in his shoulder and broke his collar bone. He was left on the mountain for dead, for a time, but was afterward removed with great difficulty, and is now recovered. Jimmy Riggins, another of the party, ran down the mountain and, coming to a snowdrift, slid down the mountain like a shot. The cloud of smoke kept pace with him, and the rocks from the crater came rolling down the mountain with a hum, and when he reached the bottom of the snowdrift he found a clump of bushes, and, diving into it, buried his face in the snow to keep out the blinding smoke and ashes. The smoke is described as causing the blackest darkness, black as the darkest night. If it had lasted much longer some of them would have been smothered.

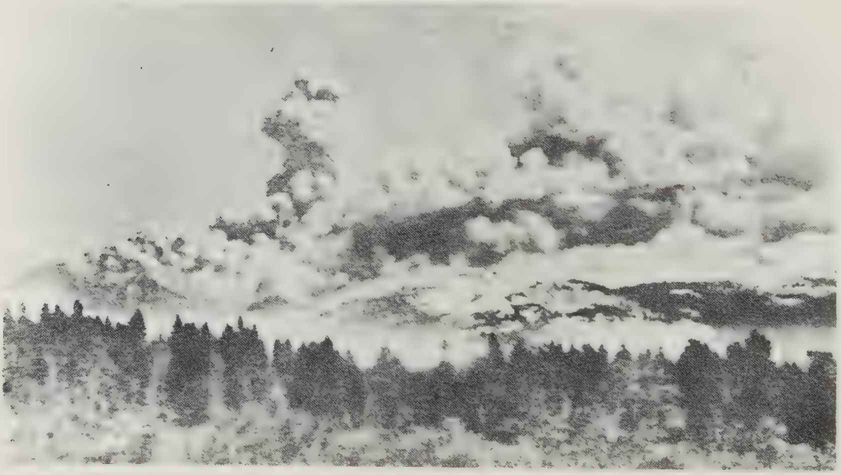


Fig. 7. Eruption of Lassen Peak, viewed from Volta, near Manton. Photo R. S. Ballou.

> One peculiarity is that all the rocks and ashes were cold, or only luke warm. Had they been hot these men would have been burned to death. Later I learned also that rocks which fell on the snowdrift inside the south rim of the crater were still lying on top of the snow where they fell. The snow being frozen very hard when they fell, but they would have melted their way to the bottom had they been hot. This snowdrift is about 600 feet south of the new crater and there was probably a thousand rocks lying on top of the snow where they fell. This snow was covered with about three inches of ashes, which turn black when wet. It is seen in the foreground in my photo of the crater. (Fig. 6).

Our pictures taken we rushed to Viola and developed the plates, then I rushed to Redding to the Valentine Studio, when we got off four sets of pictures for the newspapers that same evening. It is certainly a wonderful series of photographs. They have been published in many of the leading newspapers and magazines, and through these they have been sent all over the world. They are in use in several universities and schools, and are now being printed in various kinds of books.

Mrs. Loomis did make an oil painting of one of this series, "Mt. Lassen in Eruption," and it was on exhibition at the Panama Pacific Exposition at San Francisco, and is now in the Memorial Museum in Golden Gate Park.

LANCE GRAHAM TELLS HOW IT FEELS TO BE HIT BY AN ACTIVE VOLCANO

Paralyzed, He Was Unable to Tell R. E. Phelps and F. A. Tipple He Was Not Dead, As They Supposed When They Dragged Him Away from Fiery Inferno

(From the Shasta Courier)

Lance Graham, the most seriously injured of the party of daring explorers who were caught Sunday morning in the eleventh eruption of Mt. Lassen, is resting comfortably in the St. Caroline hospital. He is the only man who ever looked into the crater of an active volcano five minutes before the eruption and lived to tell the tale.

When seen by a Courier Free Press reporter Tuesday morning, Mr. Graham said:

> Our party, consisting of F. A. Tipple, R. E. Phelps and myself, prompted by curiosity pure and simple, left Manzanita Lake early Sunday morning for the purpose of view-

ing the crater at close range. The ascent of the mountain was a strenuous task, as in places the snow was very deep. Where there was no snow the side of the mountain was so rough and jagged that we reached the summit with great diffculty.

As we stood on the rim of the crater looking into the irregular great cavity, the three of us became nervous. I climbed a higher point than the others. Perched on a high rock, I was seized with a premonition of the impending danger, and my one impulse was to get away. Somebody suggested that we "beat it." I was entirely agreeable to this, but for some unknown reason, though the others started down the mountain at once, I remained behind for about three minutes.

Just as I turned to leave the crater's rim, there was a puff of blue smoke, followed by a tongue of red flame that resembled the discharge of an old fashioned cannon. My impression is that there was a dull rumble accompanying this outbreak, but of this I am not certain. I started to pick my way down the mountain, but in a trice I was enveloped in a cloud of smoke, while a perfect hail of small volcanic bombs and cinders beat down upon me. Then I was struck by a stone about twice the size of my fist and felled me to the ground.

My senses gradually left me and I seemed to be floating

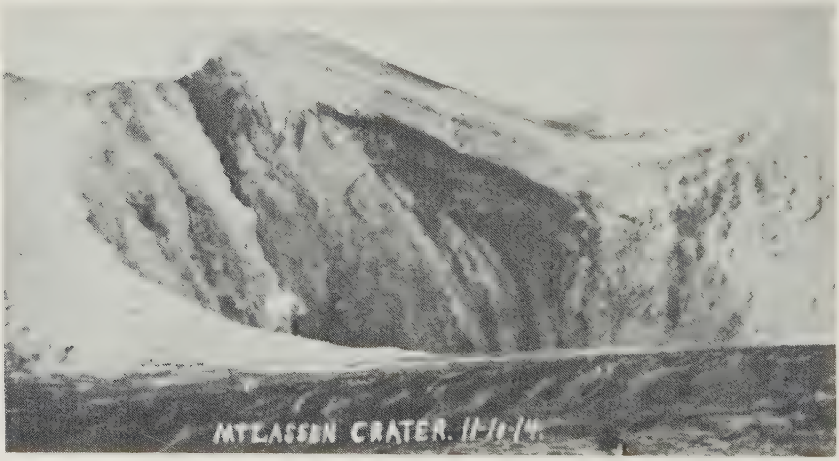


Fig. 8. The crater, showing deep hole looking northwest. The snow in the foreground is black from the volcanic ash which shows as a lighter color at the top of the crater. The ejected rocks and debris formed layers 10 to 20 feet deep. Photo Hampton.

out into space where all was peaceful and calm. I have no idea of how long I lay on the mountain side, but I was conscious of the fact that my companions had left me for dead. I was paralyzed; at least my vocal organs refused to respond to my efforts to articulate. When the eruption was over and the atmosphere cleared, my companions made a search for me, finding me completely covered with ashes and cinders. They started to carry my supposed dead body down the mountain.

At this time I was fully aware of what they were doing and of the fact that they thought me dead. I cannot explain this, but it seemed to me that I was for the time being a disembodied spirit, viewing its own body from another sphere of existence.

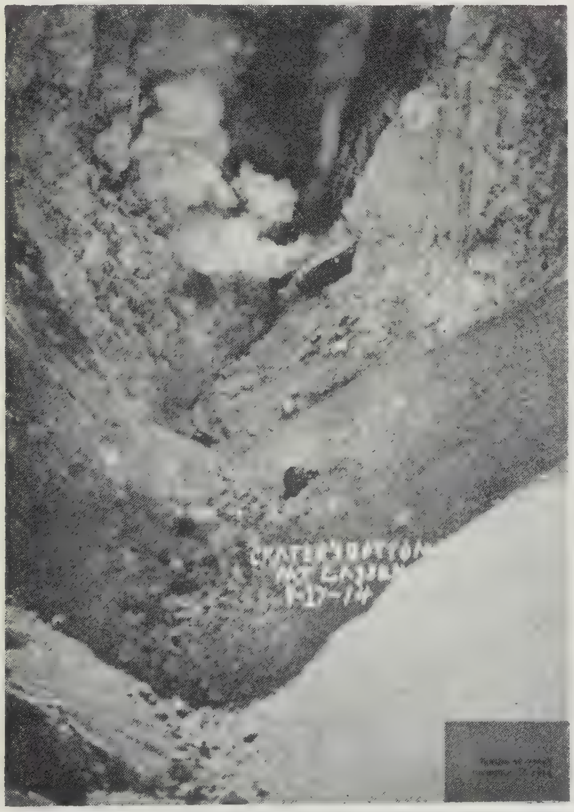


Fig. 9. Bottom of crater with steam at the farther end. The debris caved in from the crater walls has filled up the crack and will be thrown out with the next eruption. Photo Hampton.

Mr. Graham is thirty years of age and a splendid type of manhood that the great outdoors develops * * * He was born at Manton, Tehama County, and has always lived within sight of the crater that so nearly snuffed out his life.

PROF. J. S. DILLER ARRIVES ON THE SCENE

(The Courier Free Press says editorially):

Professor Diller, geologist for the United States Geological Survey, arrived in Redding Thursday evening, coming direct from Vancouver, B.C., where he was when he received orders from Washington to proceed to Lassen Peak and make a report on the eruptions. He has orders to prepare a bulletin for the press of the country giving the exact status of the volcano and what may be expected from it. The bulletin will be issued from Washington.

Professor Diller left this morning for Manzanita Lake, where he will establish his headquarters at a safe distance of five miles from the crater. He is the guest for the day of G. R. Milford, superintendent of the Northern California Power Company, who directed from the Volta power house that the company's automobile should convey him ıo Manzanita Lake.

Professor Diller made his first visit to the crater of Lassen

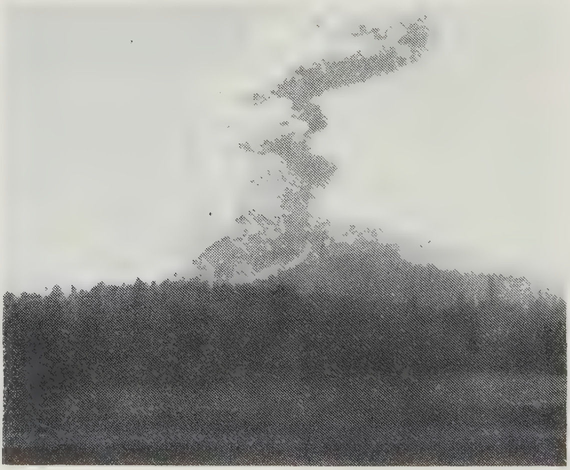


Fig. 10. Eruption of Lassen Peak, viewed from Lost Camp.
Photo R. L. Fillmore.

> Peak in 1883. Since then he has made the ascent several times and, as is well known, made an exhaustive study of the volcanic region. His report published in the nineties to the United States government is a geological classic.
>
> Professor Diller in Redding Thursday for the first time saw photographs of the recent eruptions.
>
> "I am amazed," he said, as he looked upon the series taken by G. R. Milford of the eruption of June 9, and by B. F. Loomis of the eruption of Sunday morning, June 14. "The story was not half told to me in the accounts I saw in the newspapers to the northward. I was disposed to doubt the newspaper accounts. These pictures are a revelation."
>
> The geologist is along in years. Grey hairs are thick. He is a much older man than when he made his first study of Lassen Peak in 1883. "I was a good climber then," he said Friday morning, "but I can climb pretty good yet. I will go close to the top this time," adding the proviso that he would be cautious and not endanger his life.
>
> Professor Diller said that he wanted complete files of the Redding papers published since May 30, as they would contain first-hand information of the recent eruptions. He said the department valued newspaper accounts coming from close to the scene. They were of great service when it came to writing up the history of the stirring geological event. The Courier Free Press has already placed at his disposal every line that has been published about the volcano since June 1, when the paper announced "Mount Lassen Is in Eruption and There Is No Mistake About That."
>
> The distinguished geologist is by no means a stranger to Redding. He has been a frequent visitor in recent years, particularly when he was in charge of certain features of the geological survey of the Weaverville and Redding quadrangles. He is well acquainted with such mining men as M. E. Dittmar and S. D. Furber. He has visited the Heroult smelter and studied the method of smelting ore by electricity. Professor Diller is familiar with the geography of the Lassen Peak region and remembers the names and locations of every creek or spring in the district.

Instead of going to Manzanita Lake as formerly planned, Mr. Diller remained at McComber Lake that evening, and the next morning, Mr. Milford and Mr. Newton came to Viola with him, and from there

Mr. Milford returned to Volta, while Mr. Newton and I accompanied Mr. Diller to Lassen Peak. The professor made his home with us all the time he was there on his first visit to the volcano.

On June 23—Professor J. S. Diller, who is connected with the United States Geological Survey, Mr. J. A. Newton and myself took a trip to Lassen Peak. Mr. Diller came to make a report on the activities of Lassen Peak. He seemed to have no right to say anything for publication, but sent in his report to the Geological Survey at Washington, when a bulletin would be sent out to all the papers at once, which prevented any particular newspaper from getting a "scoop." This worked a disadvantage to us, as we wanted to know his opinion on various matters, and generally he gave us quite a bit of information in a general way, but he was not so open-minded as I think he would like to have been. Therefore I can give only an independent opinion based upon my own observations, and such knowledge as I have gained from various sources.

We went to Manzanita Lake in an auto, and from there we took the trail on foot. The wind was from the southwest, so we went up Manzanita Creek a long way to be on the windward side, so we would not be suffocated in case an eruption occurred. We then climbed the mountain from the southwest side, reaching the top at about 2 p.m. I took a photograph of the crater from two different points. After Mr. Diller had made his observations we returned by a shorter route.

We found the crater much larger than formerly. In fact, it was getting larger with each succeeding eruption. I did not make any measurements, but it was probably 400 feet long. Some smoke was issuing from the crater, but not very much. The snow bank on the south side from where we took the photograph, was covered with about three inches of ashes which turns black when wet, and an abundance of rocks lying on the snowdrift which had been thrown out of the crater.

There was real danger in going up there, as those rocks had been thrown two or three hundred yards, and some of them weighing ten, twenty, fifty and a hundred pounds. These were to be found all over the snowdrift a few feet apart, while at the bottom of the crater the debris was several feet deep. The hole had now reached the northwest rim of the original crater, and nearly to the southwest rim.

The ashes from the crater have blackened the snow on nearly all sides of the Peak, to some extent, but mostly on the east side, as the wind usually blew that way. On the north side it extended down to the foot of the Peak, but not much below the timber line. It was considerably heavier on Lost Creek and Hat Creek.

At Lost Camp they were obliged to dig a well, as the water in the creek was so full of ashes it was not fit for use. The Hat Creek water was affected to some extent, but not so much as it was farther away. Some ashes settled on the grass, and it was believed by some that this would damage the feed, but it did not seem to do any harm to the stock. Very little ash was to be found in the Manzanita Creek section, as most of the smoke went farther toward the east.

It was not anticipated that the volcano would do any harm, other than throwing out ashes, steam and smoke. Of course, if any one should go up there when the mountain was blowing off then there would be great danger, but it seemed to be harmless at a distance.

It was amusing to read of some of the extravagant things some papers printed about our volcano. One prominent paper said there were three distinct craters, while there was only one, and there had been no more up to that time. Some of their pictures never saw a camera, but they were the product of an active imagination by those who never saw the mountain. A few others also seemed to think that the small dam at Manzanita Lake, and also the making of the artificial lake Almanor had something to do with the eruptions of Lassen Peak. This was on the hypothesis that this water would find its way into the subterranian caverns and thus start the volcano to working again. This extra amount of water held on the surface of the earth may possibly have had something to do with it, but I believe it is the opinion of scientists that this was merely a coincidence.

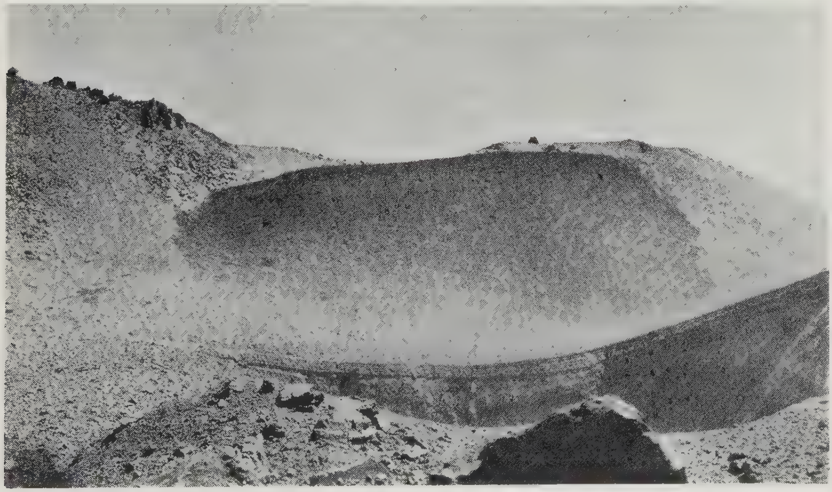


Fig. 11. View of the top of Lassen, looking south, showing crater nearby. The snow bank, black with ash, and the lookout house on the highest peak at the left. Below the snowdrift is the bottom of the old crater which terminates in the notch at the right, through which the new lava flowed in the eruptions of 1915.

EXPERIENCES NEAR THE CRATER DURING ERUPTIONS

(From the University of California Publications, Vol. 1, p. 312)

> An interesting series of eruptions occurred June 12, 13, and 14. On Friday, the 12th, Forest Ranger Abbey and a party of five were climbing upward half a mile from the crater, when with a great roar the mass of ashes and boulders shot into the sky above. Immediately stones began to fall about them, and three hundred pound boulders began to drop a short distance above and bound down the mountain side toward them. The party ran to shelter behind a point of rocks on the ridge. Milton A. Ayres, the San Francisco moving picture operator, alone faced the storm. Setting up his machine on a boulder, he began to turn the handle. That night he told the story of his experiences at the volcano.
>
> "We had no warning. The roar and the uprush of the black smoke above were simultaneous. The rocks began to fall on the mountain side; the gases did not come our way much, as the wind drove them to the east, but we got some strong whiffs of sulphur smoke. For the same reason little ash fell where we were.
>
> "Later we went on to the summit, reaching it at 6 p.m., two hours after the eruption began. We found the whole mountain top strewn with great boulders and heavy ash. No one could have possibly lived at the top while the outburst was on. We climbed up to the shelter house, where we had expected to spend the night, and found it in ruins. Boulders had crushed down through it and splintered the building into kindling wood."

No, the building was not splintered into kindling wood, for only a few rocks had punched a few holes through the roof, while the house still stood until in October, when it was utterly smashed flat with the ground.

Some newspaper reporters sent in some extravagant reports to their papers. Mr. Abbey told me of one who came to Mineral, and seeing an eruption, rushed to the telephone and sent in the report that "The whole top of the mountain is blowed off."

Another reporter came to Viola, intending to go to Manzanita Lake, but when he heard that there had been an eruption that morning, he was afraid to go any further, but telephoned to his paper that the mountain had "Filled the country with smoke and cinders for miles around," and a lot more junk, when he had never seen the mountain at all at close range.

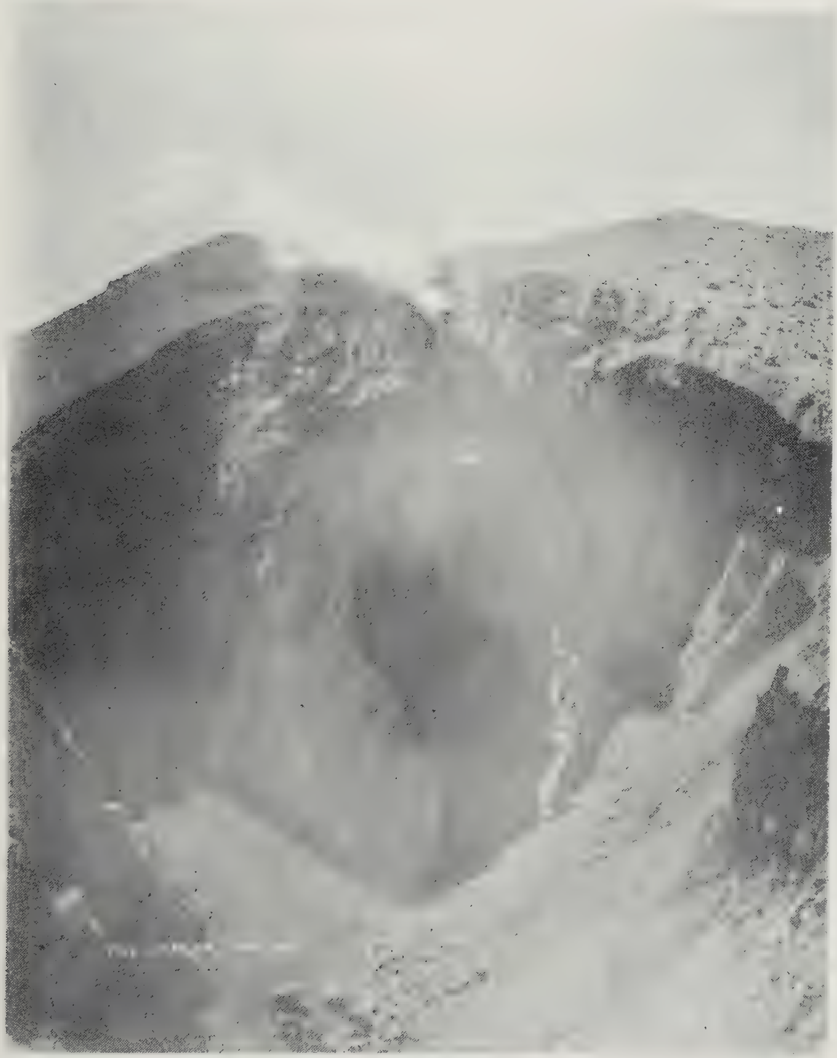


Fig. 12. The Crater, October 12, 1914, looking Northwest. Notice the steam vent is at the top of the solid rock wall of the old crater rim.

Four successive views of the Lookout House on top of Lassen Peak.

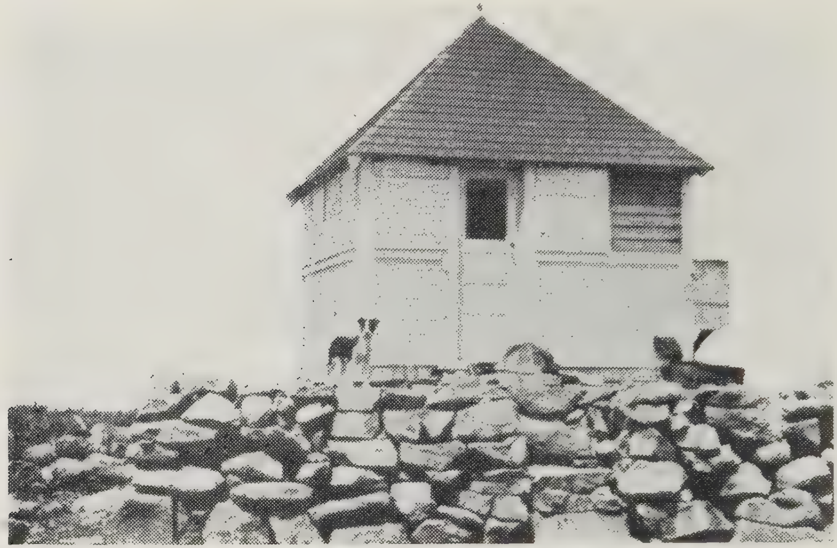


Fig. 13a. Before the eruptions. Photo Hampton.

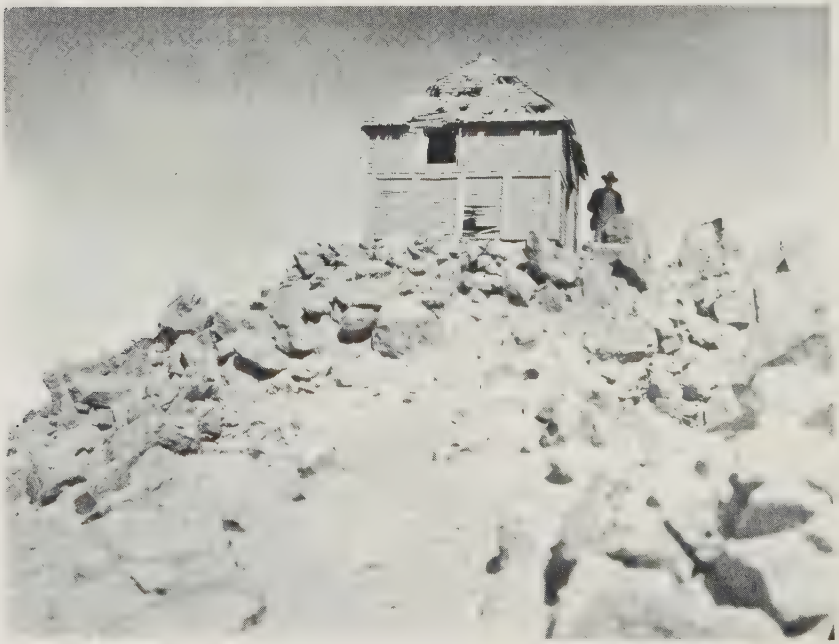


Fig. 13b. Its condition on October 12, 1914.

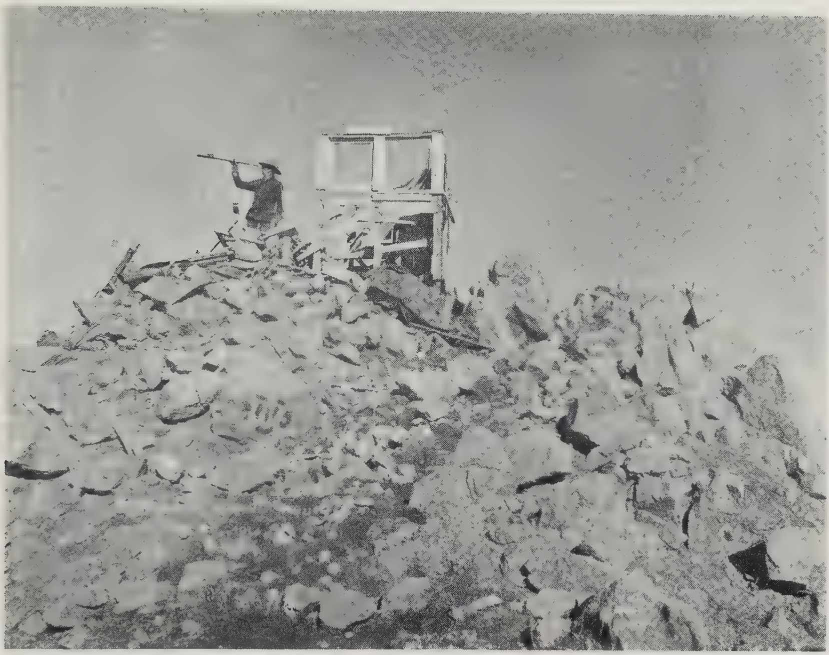


Fig. 13c. The Lookout House on October 20, 1914.

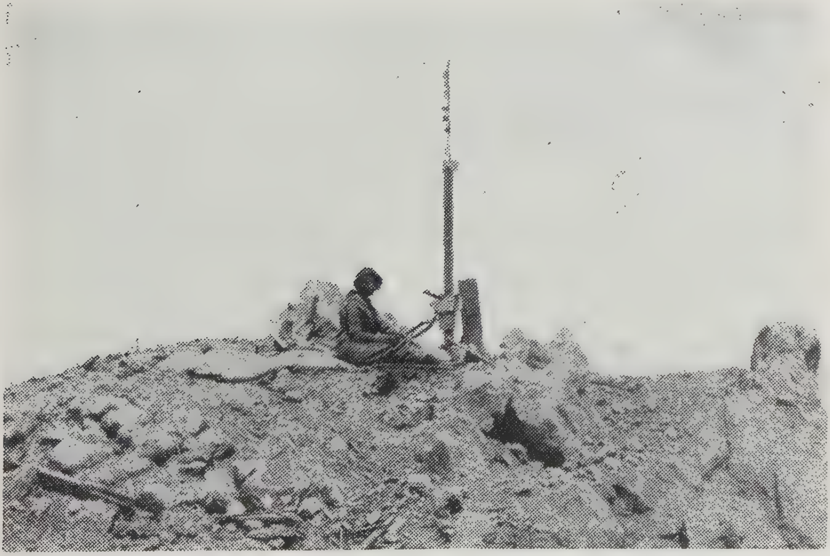


Fig. 13d. The remains on August 8, 1915. Photo Hampton

The lookout house had been completed about a year before the eruptions began. It was a four-sided structure, with four windows on each side, and furnished with a good telescope, so that one could look all over the country, and in all directions. The house was fastened down with cables to keep it from blowing away, as the wind blows very hard on top of Lassen Peak. Our series of four pictures (Fig. 13) show the

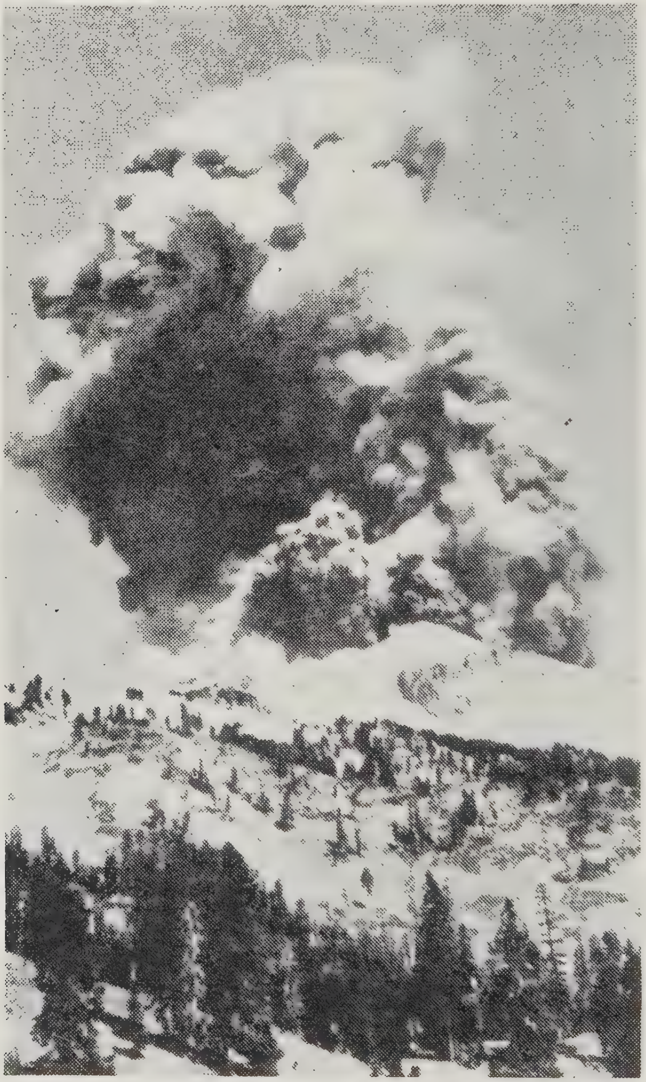


Fig. 14a. Vulcan Face, two views. Notice the smoke cloud assumes the form of a human face. Photos by a Forest Ranger.

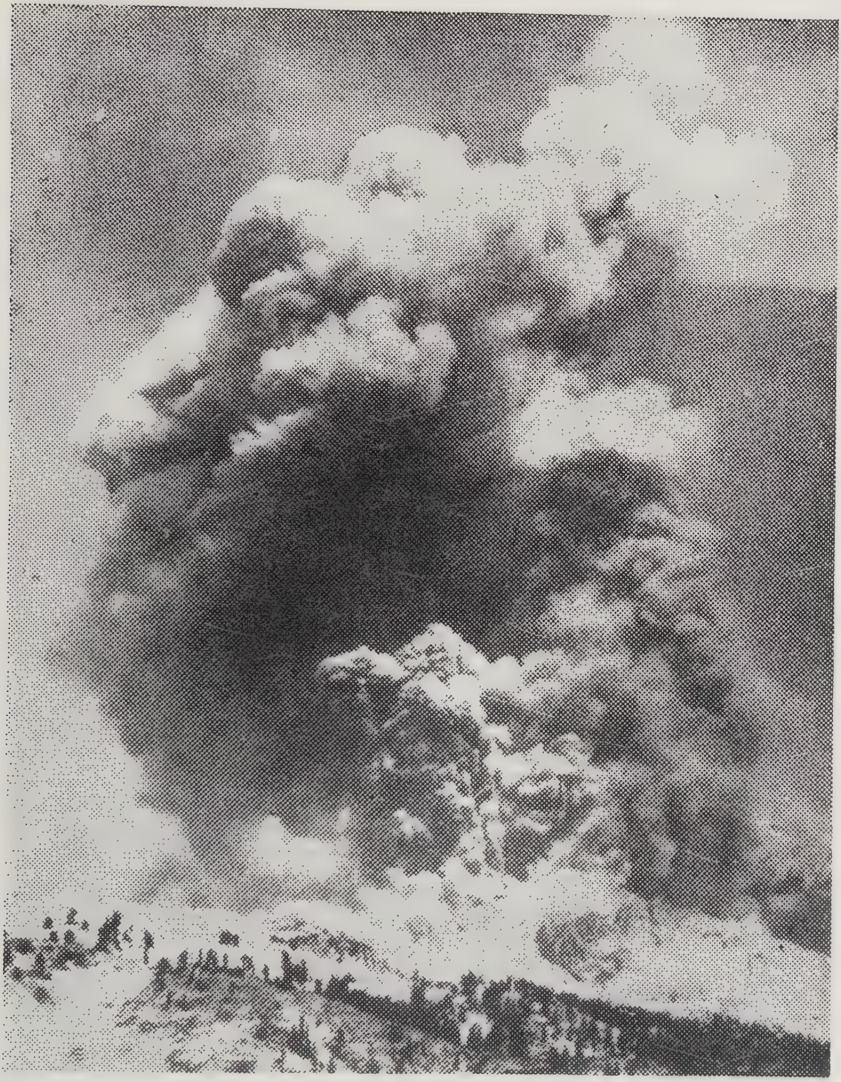


Fig. 14b. The face is deforming, and is soon lost to view.

condition the house was in after the successive eruptions of 1914. The house was entirely demolished in October, 1914. Notice, too, that the stone wall upon which the house was built was also battered down by flying rocks from the crater.

The smoke clouds often assumed various forms and shapes. On August 19, 1914, the cloud assumed the form of a human face (Fig. 14), and was photographed by one of the Forest Rangers and sent to R. E. Stinson at Red Bluff for development. When it was found that the cloud looked very much like a human face, Mr. Stinson had the picture copyrighted. The second picture of the series, taken a few seconds later, the face is seen to be vanishing away.

On this same day, Mr. and Mrs. Charley Bond of San Francisco were camped at Manzanita Lake, and on this day climbed to the top of Lassen Peak. When near the top the mountain blew off, and Mrs. Bond

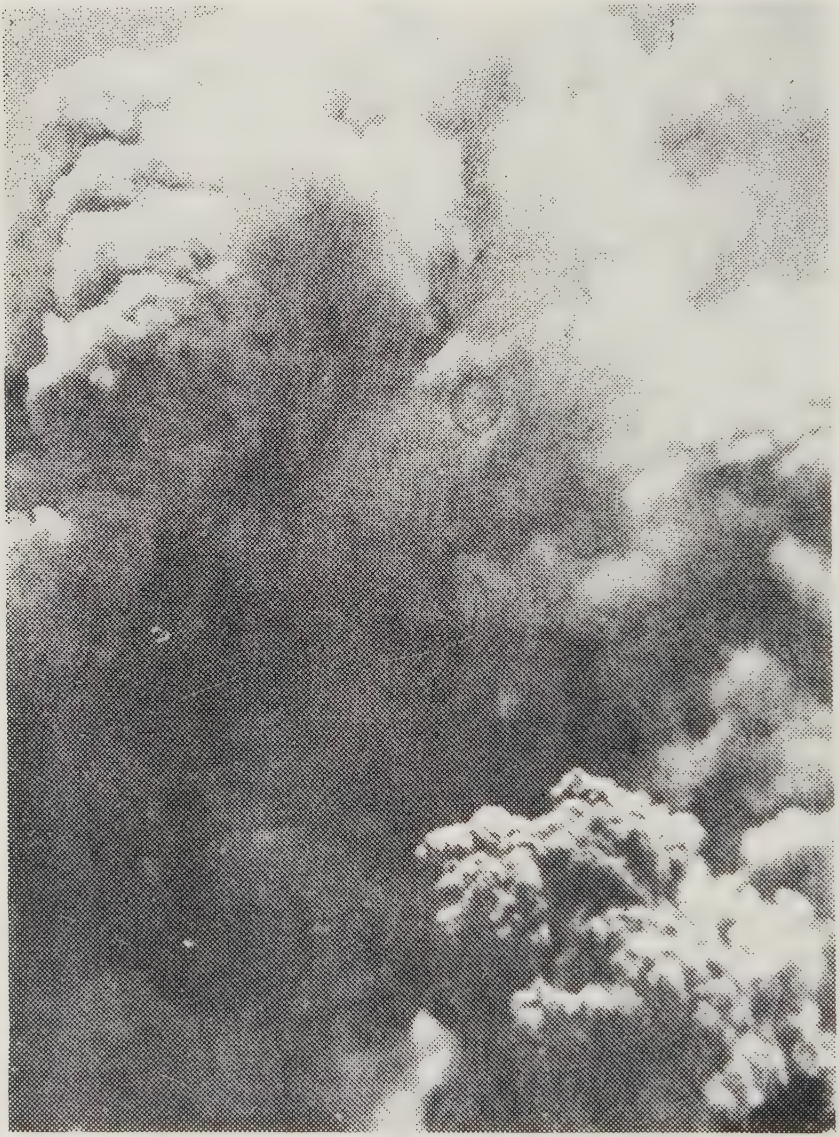


Fig. 15a. Lassen in eruption, August 19, 1914. Photo Mrs. Bond.

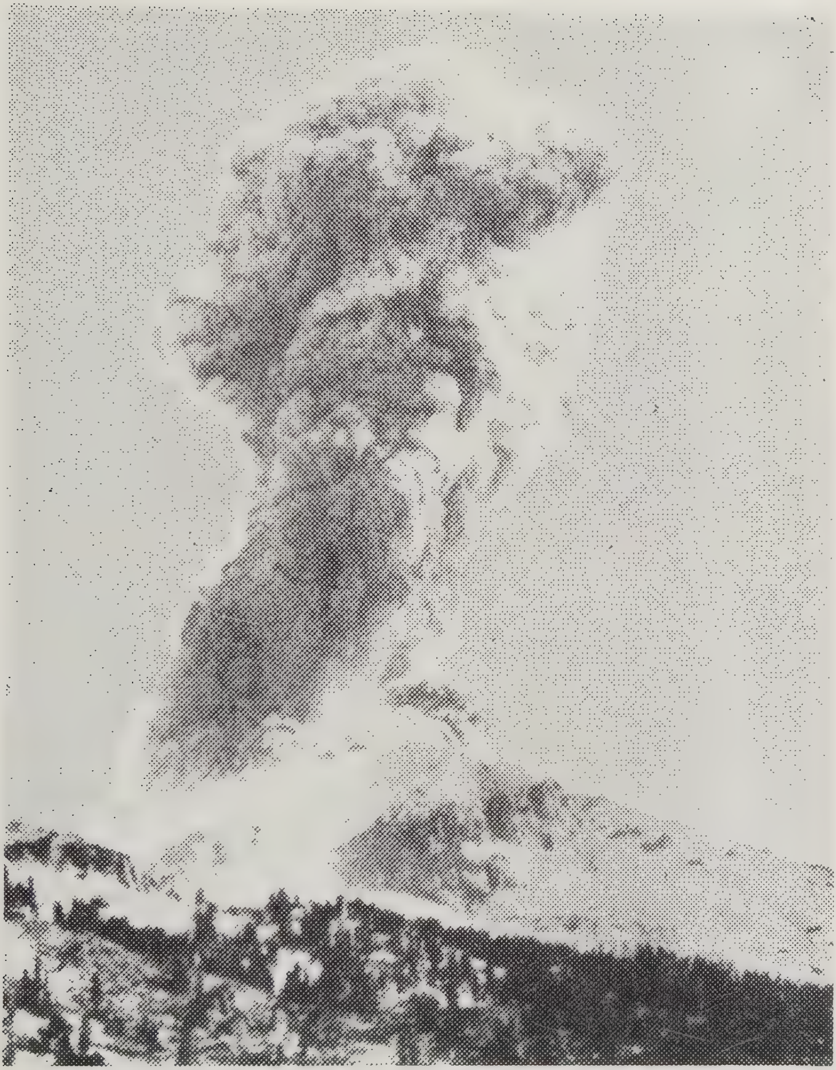
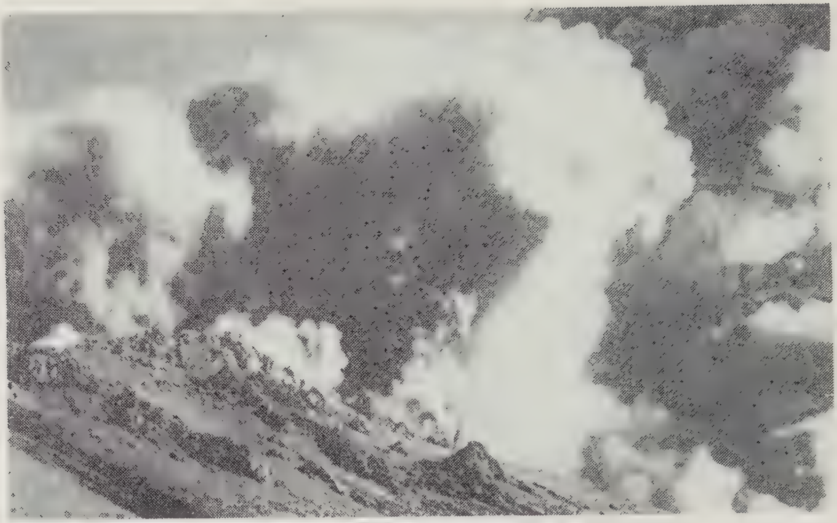


Fig. 15b. Lassen in eruption, date and photographer unknown.

secured a series of four very nice views. One of them (Fig. 15a) was taken a few seconds before the Vulcan Face, and they were also at close range, so that her camera did not take in all of the smoke cloud. It is seen, however, that it very closely resembles the other two Vulcan Face views. They were so close up that the rocks fell around them where they stood, and at one time the smoke came down over them in a blinding cloud. It soon passed away, however, and they went on up and got a view of the smoking crater (Fig. 16).



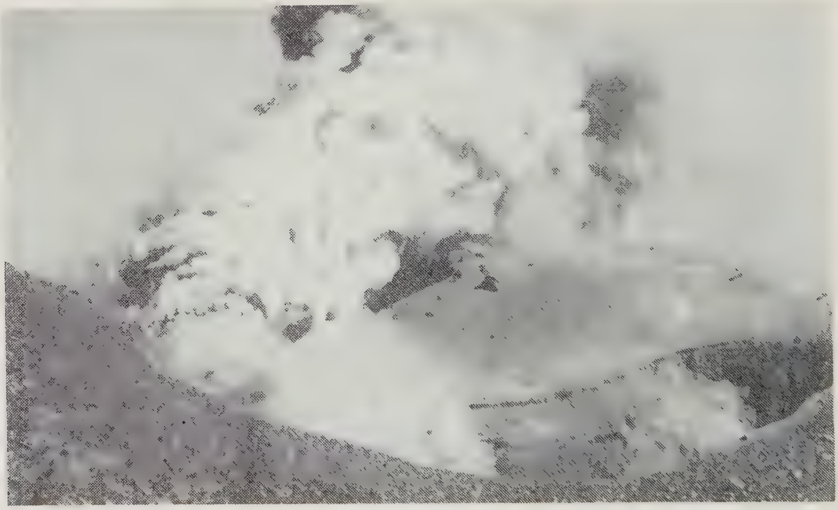


Fig. 16. Lassen steaming after an eruption, two views. Photos Mrs. Bond.

Occasionally a horse was taken to the top of Lassen Peak. Tom Lee claims to have been the first one, but after the eruptions began in 1914, there may have been several times when they were led to the top of the Peak. Our picture by Mr. Hampton (Fig. 17) shows one of them. There is a Forest Service trail to the summit of the Peak, but they usually leave the horses at the timber line.

On October 12, Mr. William Forrest and I took a trip to the top of Lassen Peak. We found the lookout house in the condition as seen in

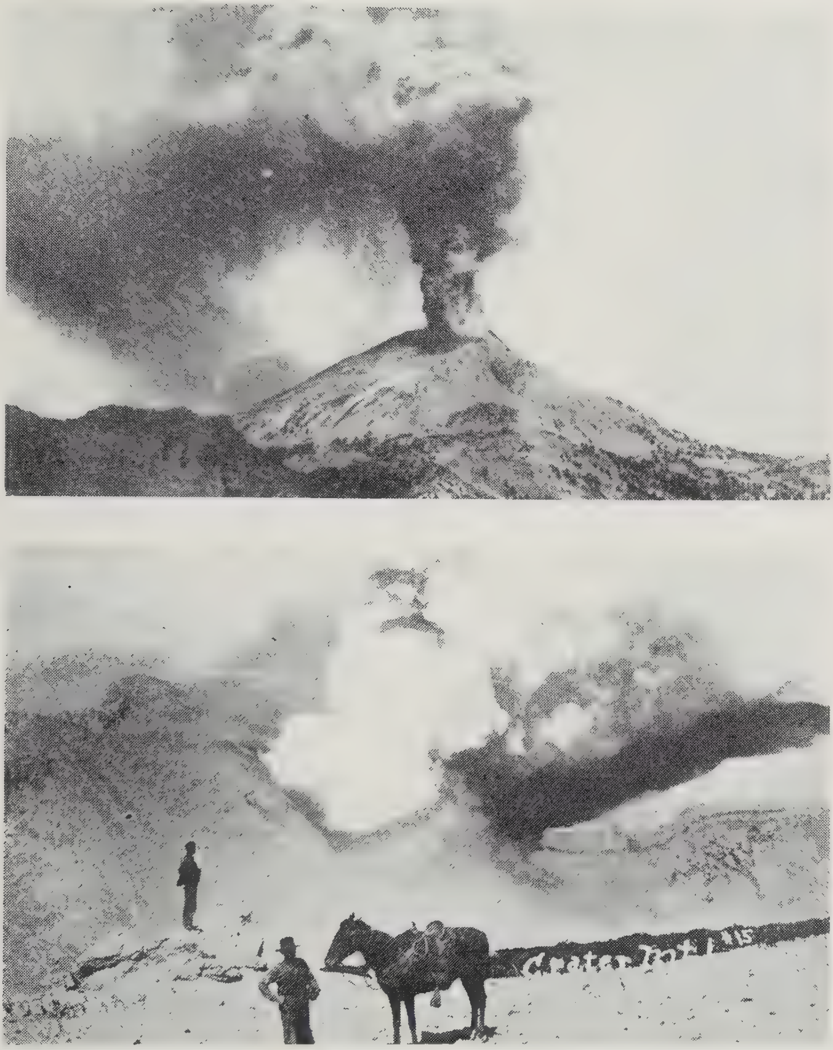


Fig. 17. (a) Lassen in eruption, showing heavy ash falling near the base of the peak. (b) Smoking crater, looking North. Notice the black snow just beyond the horse.
Photos Hampton

fig. 13-b. Several holes were punched through the roof, and the walls were damaged to some extent, but they were still intact. The rock wall, upon which the house was built, was knocked out of shape and the rocks were scattered around, as can be seen by comparing the several pictures. The crater was some larger than in my earlier visits, and the steam jet was coming out at the top of the solid rock wall at the west end, while no steam was coming from the bottom of the crater (Fig. 12).

On October 20, I again visited the Peak in company with Mr. Arnold. We found the lookout house demolished as seen in Fig. 13-c. Only a few pieces were left standing. Mr. Arnold is seen in the picture with his telescope. While at the lookout house I took a photograph of the top of the mountain, looking northwest, showing the great hole, and the steam now coming out of the bottom of the crater instead of at the top as seen ten days before. On October 15 and 17 other eruptions occurred, and one of these had torn the solid rock wall away as seen in Fig. 18.

The crater was still enlarging westward and on the west side of the Peak several hundred feet below the old crater rim, steam vents were to be found in several places. It gave one the impression that the west side of the mountain was weak, and would be torn away perhaps, in case the eruptions continued. No steam was coming from the east end of the crater. Strange to say, however, it was at the east end that the great destruction was wrought in the great eruptions of 1915. They tore away the side of the Peak where to all appearances the crater wall was the strongest.

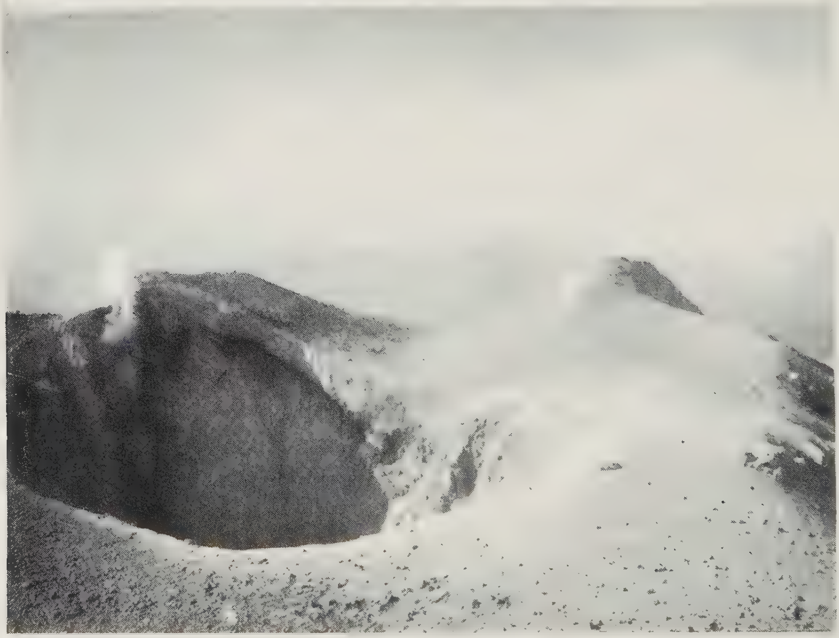


Fig. 18. The crater, showing deep hole, looking Northwest. Viewed from the lookout house. Notice the steam jet is now coming from the bottom of the crater, while a week ago it was coming from the top of the solid rock wall, seen in Fig. 12. Subsequent eruptions tore away the east end of the crater to the right, and the great eruptions of 1915, so violent, tore through the east wall of the peak where apparently the crater wall was the strongest.

Notice the layer of ejected material around the top of the crater bowl, ten to 30 or 40 feet deep and each eruption added to its depth (Fig. 18).

I never measured the size of the crater, but at this time it was considerably larger than when it was visited by Mr. Holway who measured it earlier in the season. I would guess it to have been 600 or 700 feet long, 350 to 400 feet wide, and something over 100 feet deep. The crater is about a quarter of a mile from where the picture was taken at the lookout house, so you can get a fair idea of its size. It was said at the time that "The City Hall" of San Francisco could be put into the crater and have considerable room left. The crater did not seem to be so very much deeper than formerly, except that the debris was deeper on top of the Peak which added somewhat to its depth. But the solid rock volcanic plug below the eroded material did not seem to be very much deeper than when visited earlier in the season.

This was my last visit to the Lassen Peak region for the season of 1914, as we move to Anderson for the winter seasons. While there were several eruptions during the winter, I did not witness or hear of anything of special interest.

THE GREAT FLOOD OF 1915

On the evening of Friday, May 21, 1915, Mr. Bert Hall of Shingletown came to Viola and said that Wid Hall's place on Hat Creek had been washed away on the night before, and that they had escaped with only their clothing, and that the Hat Creek country was deluged with mud. It was supposed that a cloud burst had occurred near Lassen Peak which had caused the flood.

The next morning, Saturday, May 22, a party of seven men from Viola, including myself, went over the mountain east of Lassen Peak to see if we could discover the cause of the flood, and see where the water came from.

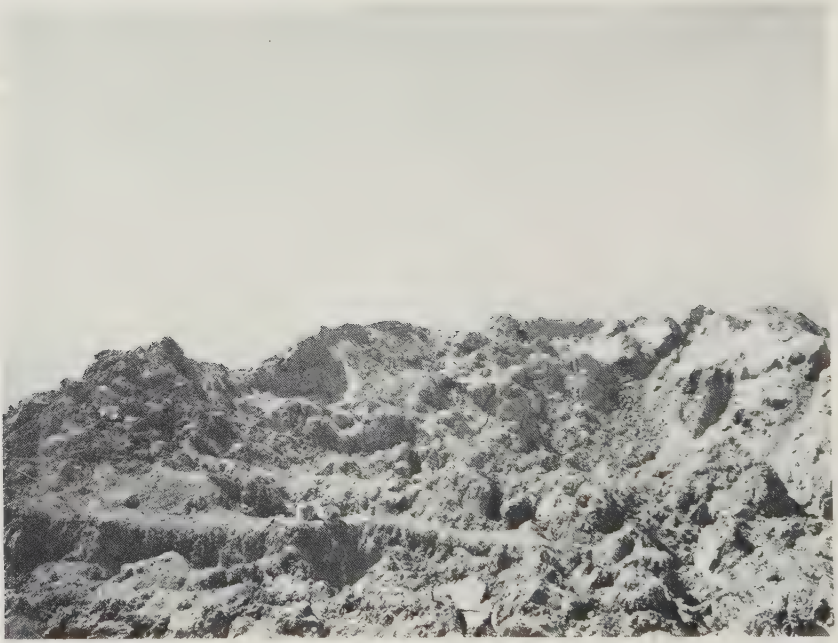


Fig. 19. Crater of Lassen Peak after the great eruptions of May 1915. Notice that all the loose eroded material, as seen in Fig. 18, was blown away by the great eruptions, and the whole volcano plug of solid rock came up in its place. Both of these pictures were taken from the same view point, the lookout house. Notice Otto Albers is standing in the center of the picture half inch above lower border. The deepest part of the crater is to the right near the north point. Some changes have taken place on the top of the peak since this picture was taken.

On our way over, when we came near the upper end of Manzanita chute, we learned that the volcano was very active, blowing off about every fifteen minutes in medium size eruptions. I took a photograph of it on our way over (Fig. 20) from near the place where I had formerly taken our series of June 14, 1914.

When we arrived at Lost Creek where the Shasta Power Company's ditch was taken out, four other men from Hat Creek joined us in our journey up the creek.

We reached the head of Lost Creek about noon, where we found that about all the water had come from the crater in Lassen Peak, which ran down the mountain side like a river. There was a great slit in the rocks on the east side of the Peak where the water came from mostly, and all the water ran down on the Lost Creek side. The land on the hillside was well covered with timber before the flood, but the flood carried everything before it and not a tree was left in the path of the flood where it came down the mountain side, and for a long way down the creek.

There is a ridge or divide between Lost Creek and Hat Creek which slopes uphill for about a quarter of a mile. It has an elevation of about

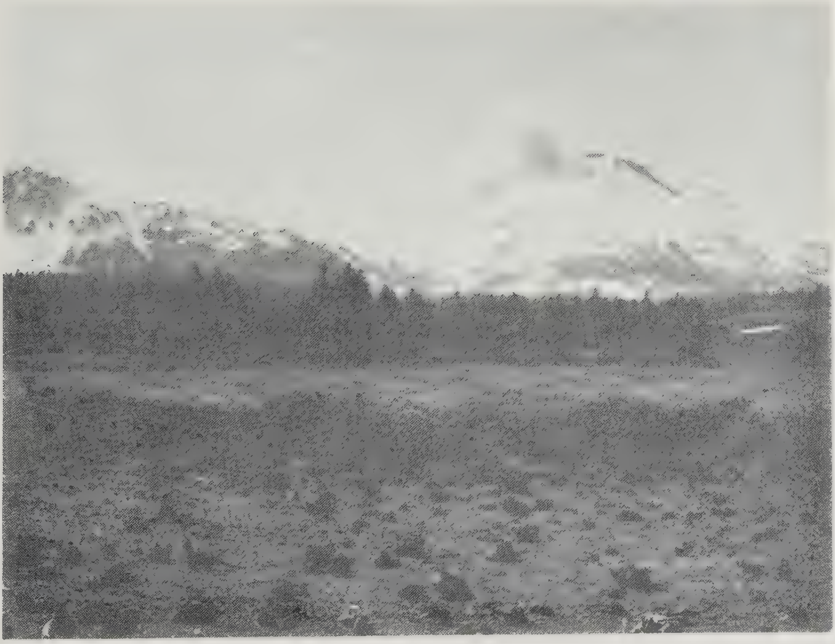


Fig. 20. Eruption of Lassen Peak on the morning of May 22, 1915. Notice the eruption is extending over the peak toward the east side. Also notice the black streak running toward the west. This was the first appearance of mud flow on the west side. The new lava flow came down at the same place.

a hundred feet, but the water had gained such momentum that it flowed over this divide like a flood for the space of near a half a mile wide. This flood was from a few feet up to eighteen feet deep on the top of the divide, as was evidenced by the mud on the trees, and also by the bark which was peeled off, and the trunks of the trees were battered up to that height by the floating debris, logs, trees and stones as they went flying past. Apparently about half of the water swirled around and went down Lost Creek, and the other half went down Hat Creek.

It is no exaggeration to say that the volume of water and mud in the two creeks must have been equal to that carried in the Sacramento River opposite Anderson at flood tide or high water mark. At the lower end of the Adams place on Lost Creek the valley is about two hundred yards wide and the mud on the trees showed that the mud flow was about twelve feet deep. All the meadow lands on both creeks are covered with rocks and debris, rendering them worthless and none of the buildings or fences remain.

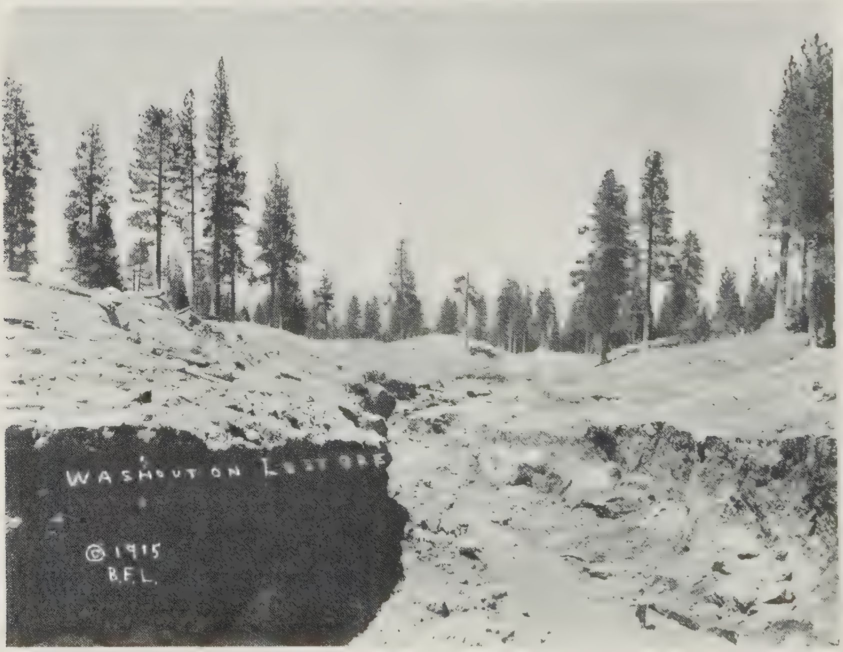


Fig. 21. Washout on Lost Creek, below the Power Company's ditch. Notice G. R. Milford at the bottom of the washout. The bank is five times as high as his head; then notice the drift logs at the top of the hill to the left, where the mud flow ran over the hill into the brush thicket and never got back into the creek. Also notice the land is swept clean of trees on both sides of the creek.

Many large rocks, some of them hot, were thrown from the crater, or torn off the lip of the crater on the west side, and carried down the creek by the raging torrents. A large hot rock[9] appears in the foreground in my picture of Lassen Peak in eruption from the head of Lost Creek (Fig. 22). The largest hot rock we saw was at the lower end of the Adams place where once his meadow used to be (Fig. 24). The Lassen Park Road passes this rock which was very hot when it was deposited there by the mud flow. This rock is about 18 feet wide, 20 feet long, and I estimated it to be about 14 feet thick. It was carried four or five miles from the crater of Lassen Peak to where it now lies. And after forty hours from the time it left the crater it was still sizzling in the water.

Just below this a large hot rock had been deposited in the mud and a pile of drift wood a few acres in extent and ten feet deep was on and around it. This hot rock had dried out the drift wood and then set fire

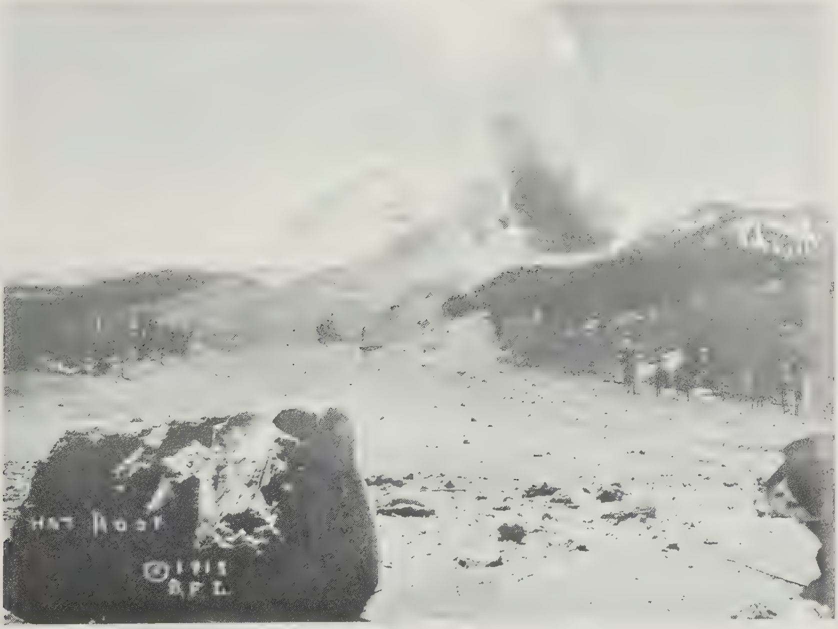


Fig 22. Eruption of Lassen Peak from the head of Lost Creek. Hot rock in the foreground. The land was all covered with timber before the flood which was all washed away by the mud flow. Lost Creek runs down to the right. Hat Creek was behind us here over the hill. The Peak was in eruption like this every fifteen minutes all day.

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[9] The present Hot Rock, a 30-ton boulder which remained hot for several days after the mud flow, is marked at Road Guide stake number 48. The "hot rock" referred to in Fig. 22, 35 and 53 is about 100 yards east of the Park Road on the rise between the Lost and Hat Creek drainages.

to it. We discovered it by the smoke and then photographed it. This story may seem incredible, but there were eleven of us who can verify the statement.

The Jessen place was once a fertile meadow, but now it is a waste of land, with not a vestige of buildings or fences to show where the place used to be. The Lost Camp ranch was also destroyed. A pile of hay was all that could be found on the place. The men from Hat Creek also said the Wilcox place was destroyed, but we learned later that it was only slightly damaged. Other places down Hat Creek were damaged to some extent but the flood had spent its force before it reached there and but little damage was done.

Only the largest trees were left standing in the track of the flood, and most of those had the bark peeled off up to high water mark on the side where it came in contact with the floating debris, logs and trees.

THE SECOND GREAT ERUPTION

On our way home that evening when we reached the Manzanita Chute where I had taken a picture in the morning, we witnessed the

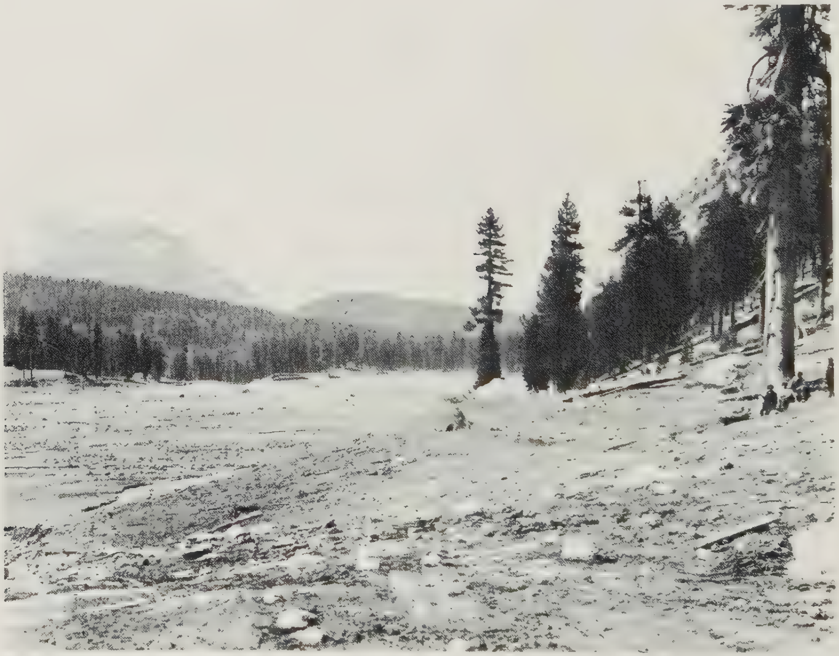


Fig. 23. In the track of the flood where it swirled and ran down Lost Creek. Notice the bark is knocked off the tree 18 feet high. The land in the foreground was mostly covered with timber before the flood, while now it is all swept away.

largest eruption of Lassen Peak which ever occurred. But I had used up all of my plates and was obliged to content myself with looking at the wonderful spectacle. Another dry plate would have been of untold value, and to the public a lasting benefit, but we were obliged to stand idly by with no chance of photographing it.

The eruption came on gradually at first, getting larger and larger until finally it broke out in a roar like thunder; the smoke cloud was hurled with tremendous velocity many miles high, and the rocks thrown from the crater were seen to fly way below the timber line before they struck the ground. As the rocks emerged from the smoke cloud they were followed by a comet-like tail of smoke which enabled us to tell definitely the path of their flight. For a short time the smoke cloud ran down the mountain side, melting the snow very fast, and the water could be seen running down the mountain side in a rush twenty feet wide. But soon after the cloud lifted going straight up so the amount of water running down our direction was slight.

A letter similar to this, to which I have made some additions, was sent to Professor J. S. Diller of the United States Geological Survey at Washington, D.C., and also a copy of it to the Courier Free Press, which

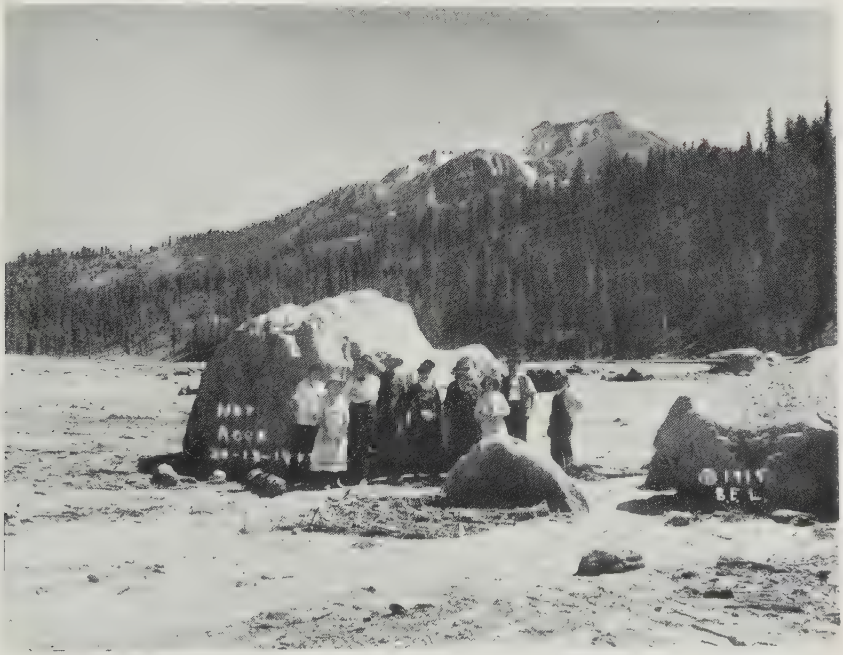
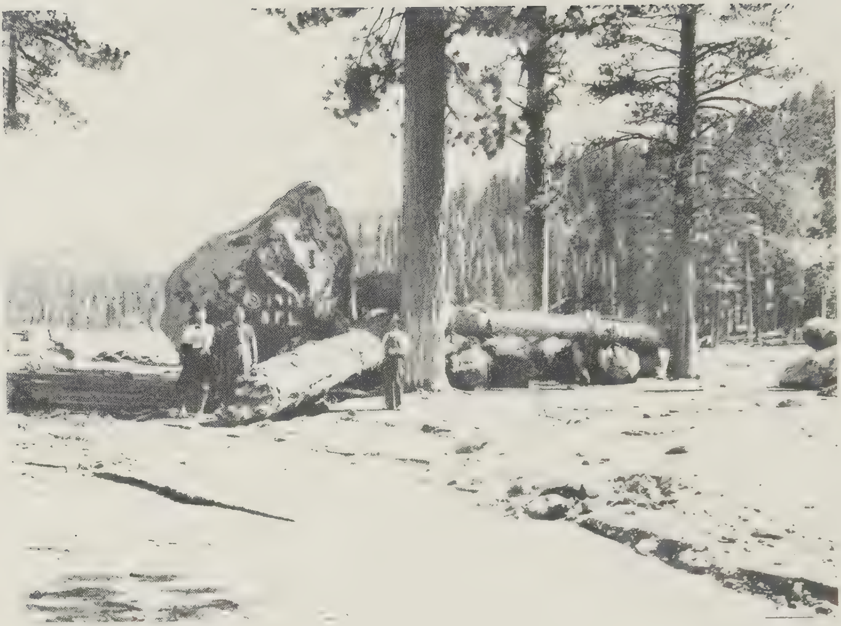


Fig. 24. Hot Rock, on Lost Creek, washed down from the crater by the mud flow. The flow came around the point of timber to the left. This rock was still hot eight days after the flood.



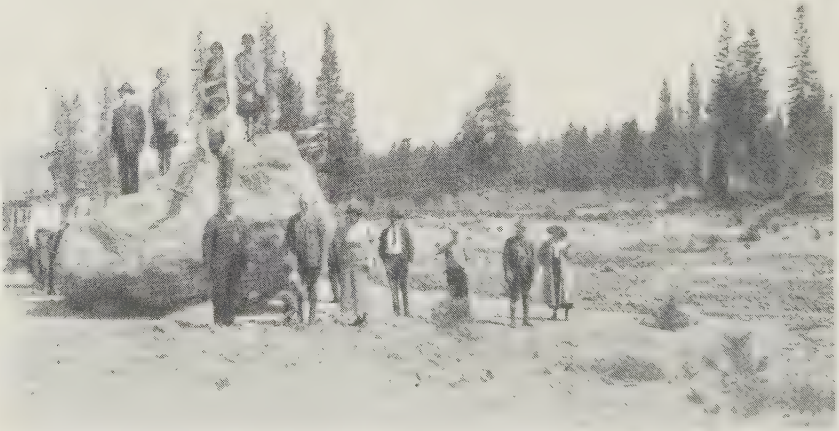


Fig. 25. Log and rock jam on Lost Creek at the Anklin Place. The green logs lodged against the trees, then the large rock rolled down and is sitting on the log. Notice other rocks are also caught under the log farther away. Lassen is shown in the distance. Notice the mud marks on the trees about twelve feet high

was published in that paper on May 26, and also a statement from George J. Grinnell in the same issue, and under the same caption, which follows:

STATEMENT FROM GEORGE J. GRINNELL

The reports concerning the havoc played by Mt. Lassen at Hat Creek being so badly exaggerated prompts me to come forth and state the facts as I found them on my trip up Hat Creek valley Sunday last.

To begin with the cause of high water in Hat Creek may or may not be from Mt. Lassen, this point has not been definitely decided[10]. The only difference I noted from normal condition was the muddy water and the volume flowing in the creek. I examined the water and found it to be as cold as ever, also tasted and smelled of some and discovered nothing that would indicate sulphur or other chemicals in solution. I believe it is nothing but dirt with perhaps a sprinkling of volcanic ash that probably falls on the surface of the creek towards its headwaters, from the intermittent outbursts.

Harvey Wilcox, a homesteader, located eight or ten miles up the creek from the main settlement, lost his cabin by the flood as did Wid Hall, a neighbor, but no live stock other than a few chickens were lost. Charles Hawkins' farm is covered in the lower places by the mud which also covers parts of the Harry Wilcox place, however. This is a natural result owing to the fact that the stream in its normal condition is level with the contiguous lands hence a very little rise in the creek will cause it to overflow its banks. Farther down the valley there is no damage done, except all the farmers' diverting dams have been washed out.

The crops never looked better and are not affected in the least by the recent high water. Owing to the muddy condition of the stream the farmers having live stock are providing clear water for them either by hauling it from nearby streams or moving the stock, this however is only temporary. Burney valley is in no way affected. It lies in another watershed separated from Hat Creek by a range of mountains.

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[10] It is now generally believed that melting snows and condensed steam were the sources of the necessary water.

Note by the Editor—

> Both the above statements of reliable and reputable citizens fully corroborate the statements of this paper, viz: That the damage caused by the mud flow is localized in the extreme upper end of the valley, on the Wilcox, Hall and Hawkins ranches, where the valley is the narrowest.

Commenting on Mr. Grinnell's letter, it is clear that he must have lived in the lower end of the Hat Creek valley where no damage was done, while the flood was increasingly greater the farther up the creek we go. Perhaps less than ten per cent of the mud flow extended down as far as Wid Hall's place. The reason is that the creeks overflowed all along the way down there, and large quantities of the mud never got back into the creeks at all, but was absorbed by the sandy land along the creeks. It must be understood that the mud flow was not a continuous stream, but it all came in a gush. The violent part of an eruption never lasted longer than half an hour, and usually less time than that. When people visit the devastated area it is a common expression with them to say: "You have not told it half as great as it really is." And

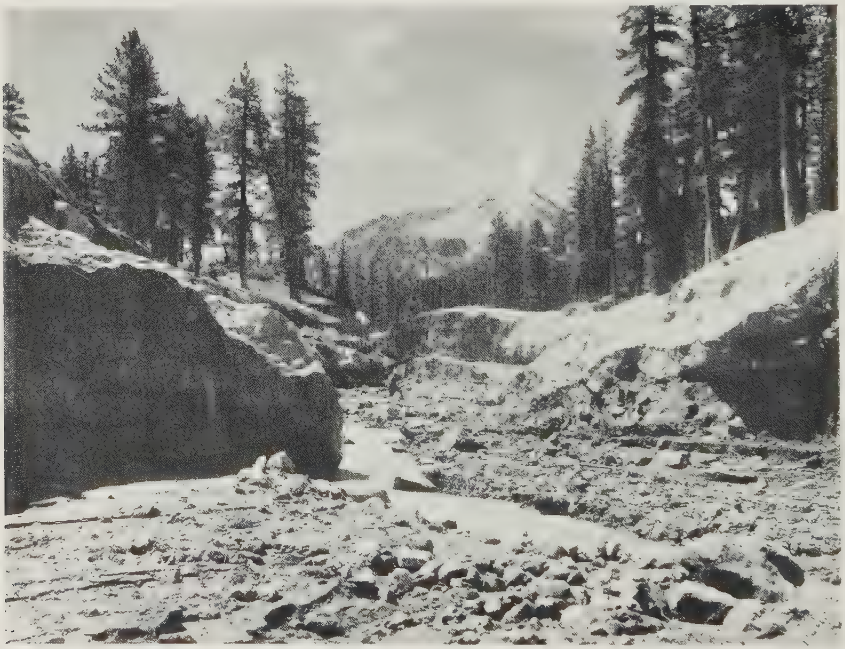

Fig. 26. Washout through Terminal Moraine on Lost Creek. Notice Professor Diller working near the creek. Our road now passes along the bank to the right. A small steam cloud is seen on Lassen in the distance. There is a soda spring on the creek just above the washout.

George E. Goodwin, Chief Civil Engineer of the National Park Service said: "It is the most appalling spectacle I ever witnessed." The accompanying photographs will illustrate this phenomena better than words can tell it.

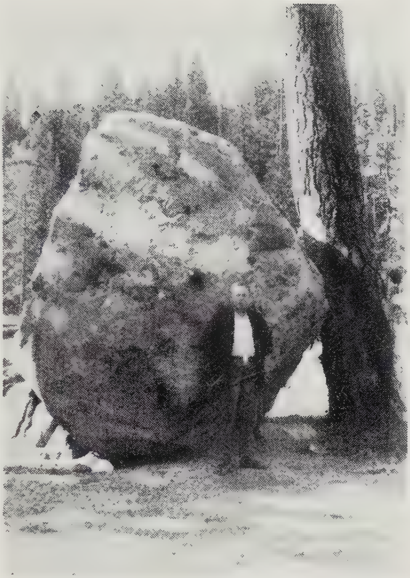

Fig. 27. Rock leaning against tree, washed down by the mud flow. Notice the tree was bruised and bark gone before the rock got there. William Halsebo is only half the height of the rock.

WID HALL'S STORY

Mr. Elmer Sorahan was a homesteader living in a tent about a mile and a half above here on Hat Creek. In the night his dog barked, raved, and stuck his paws against him in the bed to wake him up. Elmer thought it might be some kind of animal, a bear or panther, so he got up and dressed, put on his high top boots and laced them up. He put his gun by the bed, then peeped out to see what the dog was barking at.

He saw the mud flow coming like a wave about twelve feet high which looked like a white streak on top. The flood made a roar something like a gale of wind in the trees, with a crash and boom of the logs and rocks as they came tumbling along in the flood. He realized that it must be a flood coming, so without waiting for his gun, he left everything and ran down the creek to awaken those who lived below him on the creek.

It was about eleven or twelve o'clock when the flood reached our place. Elmer came with a rush, and he was perhaps five minutes ahead of the wave that struck our house. He gave a yell that startled us, and we all jumped up in a hurry. Frank Bartlett happened to be staying there that night, but he was sleeping in the barn across the creek, 150 yards distant. Elmer then ran across the creek to awaken him, and just got back across the creek when the bridge went out. Frank remained on the other side. In the meantime, Mrs. Hall telephoned to the people below on the creek that the flood was coming. The people on the lower Hat Creek were very much excited, but the flood did but very little damage below the Wilcox place, and it was near daylight when the flood reached the lower Hat Creek.

As soon as Elmer returned he took the two girls, one by each hand, and beat it for higher ground. The older girl, Marian, was fairly well dressed, but the younger one was too slow and had no shoes on, and in their haste she stubbed a toe nail off. The crash and roar of the flood was so intense that you could hardly hear one yell even at a short distance.

After we went to the woods it began to rain, so we went to the high ground, and made our camp under a tree. I had just two stubs of matches in my pockets, and we managed to get a fire.

About three o'clock we tried to get back to the house, which had moved 53 feet and lodged against a tree and the yard fence, but could not reach it at that time. We had some provisions in the house that were not affected by the flood, so we could eat. On leaving the house we left the door open and the flood entered about two and a half feet deep, then on the ebb flow part of the mud and water ran out, but when the mud had dried it was about sixteen inches deep in the house. A green log also had floated in, a rough old thing, which was about all four of us could do to get it out of the house. The mud flow looked more like mortar than water, and where it ran over the ground it left it slick and smooth like a pavement.

When daylight arrived, five of the neighbors from below came to our assistance with horses, but the trails were so bad and rough, that we declined to go away. But during the day we put in a temporary bridge across the creek so we could get to the barn where the horses were, so if anything serious should happen we could get away. Water had run through the barn, but not enough to take it away. On their way over, the younger girl, Evelyn, saw a small pond of muddy water and asked if she could wade through it. And when she did so, found that the water was warm, something more than 'milk' warm, and that was in the afternoon of May 20th.

Harvey Wilcox lived on Hat Creek below Wid Hall's place, and he also was wakened by his dog, and just had time to grab his overalls and run. He had but a short distance to go to get on high ground. He had a log house, and had just brought up two stoves, some furniture and dishes, but had left these all outside while putting in some shelves. But after the flood cleared away nothing was left, house, stoves and everything gone. He had three or four miles to go through the lava beds. This was in that part of the country where the Hat Creek Caves are, in "The Devil's Half Acre." The lava rocks there are very rough and craggy, not a very good place for one barefooted. By the time he got through his feet were cut and bleeding all over. He had a gash cut in one foot about one and a half inches long and a quarter deep. He arrived at Wid Hall's the next morning about nine o'clock crawling on his hands and knees, and his hands were blistered and cut. At Hall's he got some barley sacks and tied his feet up then he managed to get along.

"I saw the form of a fish in the mud, and scraped the mud off with my foot, when the skin slipped off the fish, and it looked like it had been baked in the mud," said Hall. After the second flood, which came down on May 22, the Hall family moved to Fall River for the summer, and did not come back until the fall.

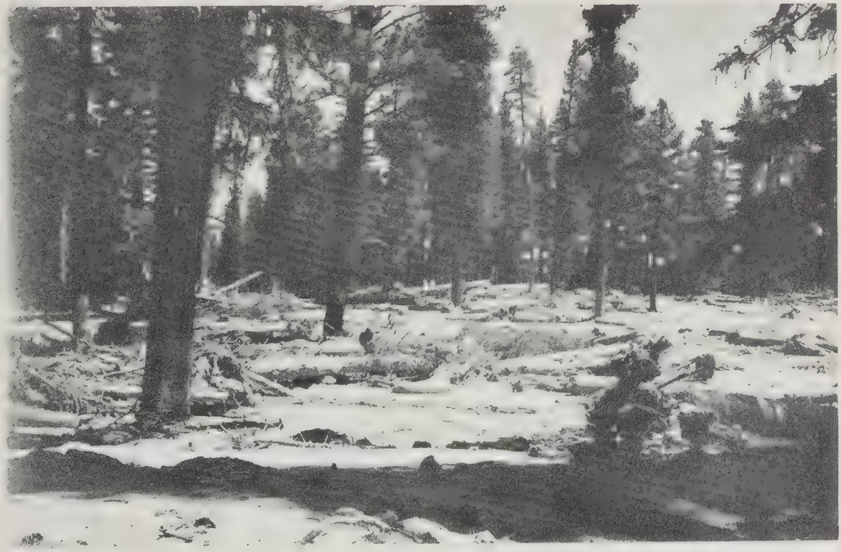

Fig. 28. Drift wood at Lost Camp. Here is an instance where there was a turn in the Lost Creek channel and the flood had gained such momentum that it left the channel and went out through the woods. This portion of the flow never reached the creek channel again. The Lost Camp house was out of the picture at the right.

FRANK HOUSTON'S STORY

At the time of the big blowout[11], on May 22, 1915, I was running a little mill on Hat Creek, about thirty miles north of Mt. Lassen. There came a flood on the twenty-first of May, but it was cloudy and stormy so we could not see the mountain. So four of us, George Hector, Frank Burnell, Roy Houston and myself, went up the creek to see what the trouble was.

We went to Big Springs that day, where we stayed over night. The next day we crossed Lost Creek and the water was not over four inches deep. But after following up the creek for half a mile we could not go any further with the team on account of the mud that had come down in the flood, so we left the team there and went the balance of the way on foot. After going about three miles we met your party, and what happened from then on until we left you, you already know.

After we had left your party on our way out, we had gone about a mile when the big blowout came on. We stood where we were watching the eruption until we heard the flood coming, and we had to cross the creek to get home, so we started on a run for the team about two miles further down the creek. We then had to drive to Twin Bridges to cross, but when we got there, the flood had beat us, and we could not cross.

We waited for the water to go down; and we had to stay there until about nine o'clock the next morning, and then the water was up to the horses' sides and to the bed of the wagon.

Then we went down to Big Springs and got our breakfast, the first we had eaten since the morning before.

Mrs. Bramhall was there and wanted me to take her out, so we packed up her things and went over to Logan Lake, and there we met Wid Hall and family. They said the flood had wrecked their house and barn, so we went down there to see what we could save, but we couldn't get anything, the mud was too deep. So we came back and stayed at Logan Lake that night, and went home the next day.

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[11] This was the great steam blast: the result of a sudden release of the pressure sealed in by the hardening of the crater lava flow which was erupted May 19. The horizontal steam blast with high internal velocity is known technically as a "nuee ardente," like the one which came down the slope of Mt. Pele, and destroyed the city of St. Pierre on the island of Martinique in the West Indies.

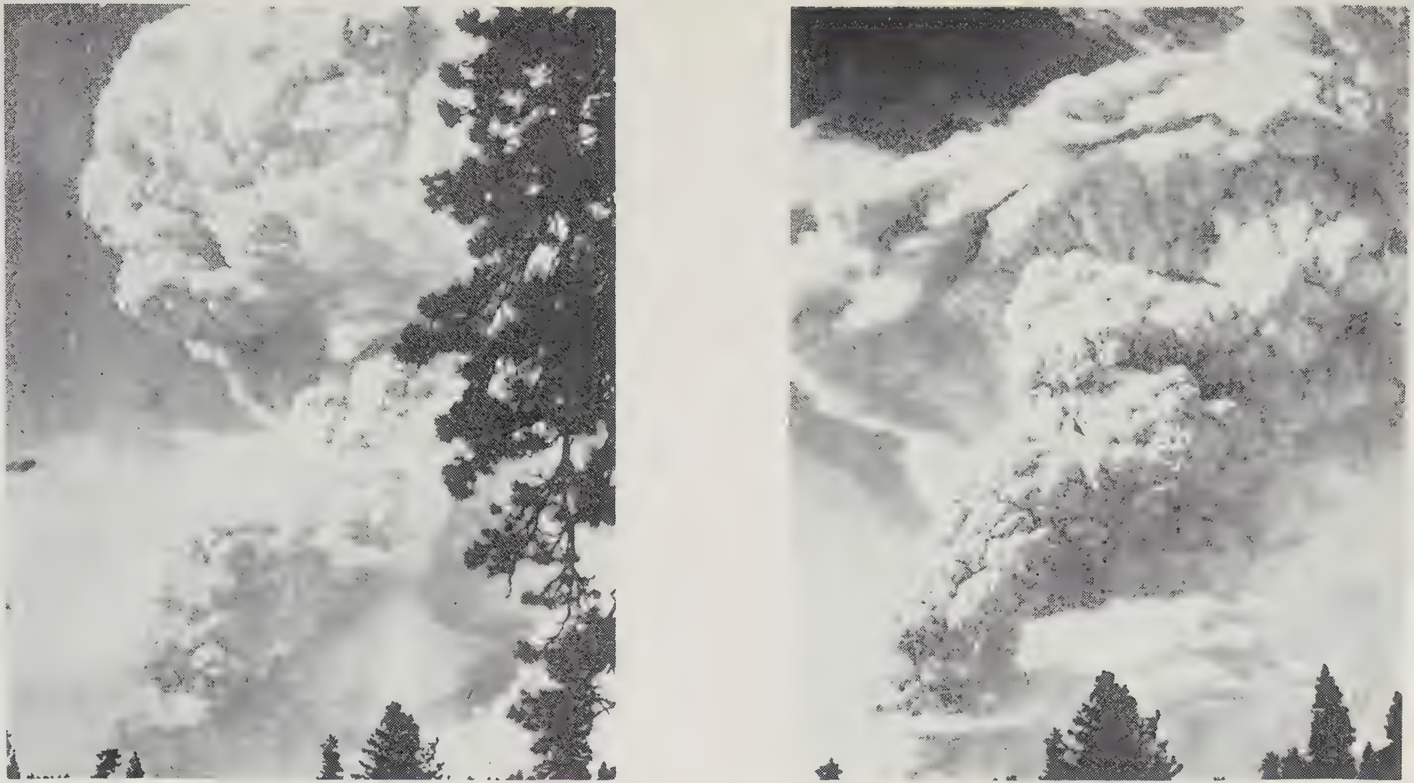

Fig. 29. Two views of the great eruption of May 22, 1915, taken from Mineral. Photo E. N. Hampton

The parties whom we have enumerated above were the only ones, so far as I know, who were in any way endangered by the mud flow.

The accompanying photographs should give a fair idea of the volume of the flood which went down Lost Creek, and when, as stated, the other half of the mud flow went down Hat Creek, it makes us realize, as Mr. Goodwin said, "It is the most appalling spectacle I ever witnessed." However, the half has not been told. We will have the other half for the present, and will come to it later.

THE STORY AS TOLD BY THE STOCKTON RECORD

After the news of the great eruptions became noised around, the Stockton Record sent two men up to Viola and Lassen to get some reliable news for their paper, and their story follows:

> VIOLA, Shasta County, California, May 24—We see Mt. Lassen sending up puffs of smoke today. We catch only occasional and momentary glimpses of the peak, ten miles from here, as the great white clouds, which continually play about the top of California's live volcano, drift by. We have scanned her 10,000 foot heights with the aid of binoculars. We are told by the oldtimers of this little saw mill camp who look upon Mt. Lassen—they call it Mt. Lawson up this way—as a possession which they prize and fear, that the only living volcano in the United States is a much changed mountain today. The two big eruptions of Friday and Saturday have altered the general contour of its summit. New craters apparently opened. There are mammoth boulders reared on her crest that were not there last Thursday. It is said that some of the ravines leading up to the peak have been filled and rounded. Forests of young timber which grew about its northeast base are gone today. Down that northeast side runs a track of mud which coursed down Hat and Lost Creeks for miles and miles, leaving destruction in its wake. This may almost be said to be a new country in the making.
>
> ### THE ERUPTIONS
>
> There are patches of snow on the mountains today which were not visible Saturday, the last clear day, the memorable day on which Lassen sent forth its mightiest roars, belching great hot boulders, some of them as large as a small homesteader's cabin, and sent skyward clouds of smoke and vapor which reached to a height of 30,000 feet. The eruption of

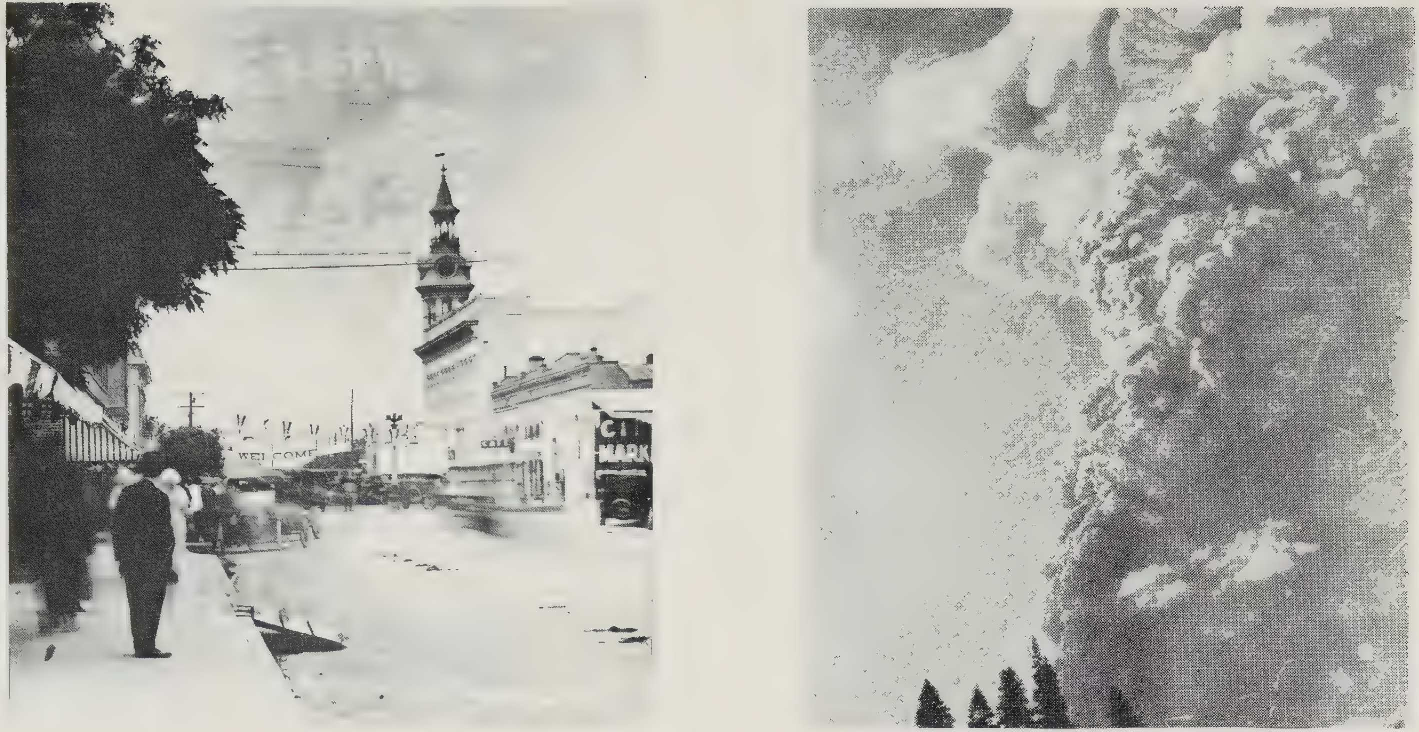

Fig. 30. (a) The Umbrella as seen from Red Bluff, May 22, 1915. Photo R. E. Stinson
(b) The great eruption of May 22, viewed from Morgan Springs. Photo Harry Kaul.

Saturday afternoon, following that of Thursday night and early Friday morning, when the mountain poured forth mud, made the loudest noise and probably hurled the most stones, but the damage which it wrought is small.

Notwithstanding the intense heat within the mountain, Lassen still wears her almost perpetual mantle of snow.

Only the path from the northeast crater, down which destruction poured Friday morning into Hat and Lost Creeks, is cleared of snow.

It stormed all day yesterday about the summit, leaving patches of new snow on the side, which was cleared by the mud eruption.

Storm Above Peak

We approached much nearer the peak yesterday than we are today, but the storm prevented us from gaining a single glimpse of the top of the volcano.

We got over into the Lost Creek country, an upper tributary of Hat Creek, and crossed the trail of mud. We saw sufficient samples of wreck and ruin to make one lie awake at night for weeks.

We hardly expect every Record reader to believe all this story. You can't believe it all unless you see it.

"This thing is almost incredible, isn't it, boys?" said B. F. Loomis of Viola to us this morning. "I'm glad you boys are here. I'm writing an account of this affair to send to J. S. Diller, of the United States geological survey at Washington, D.C. I want him to come out and investigate this thing. I was afraid he would not believe my story. Well, after the world reads your story, they will have to believe mine, won't they?"

The Flood of Mud

Fourteen miles from here, down in the canyon of Lost Creek, just about 300 yards from and about 200 feet above the mud flood line, there is an automobile with a broken front spindle. The auto belongs to Joseph F. Johnson, foreman of the Record's composing rooms. It bears three banners reading, 'Stockton Record to Mt. Lassen.' It's the machine that brought us up here, over 200 miles from Stockton.

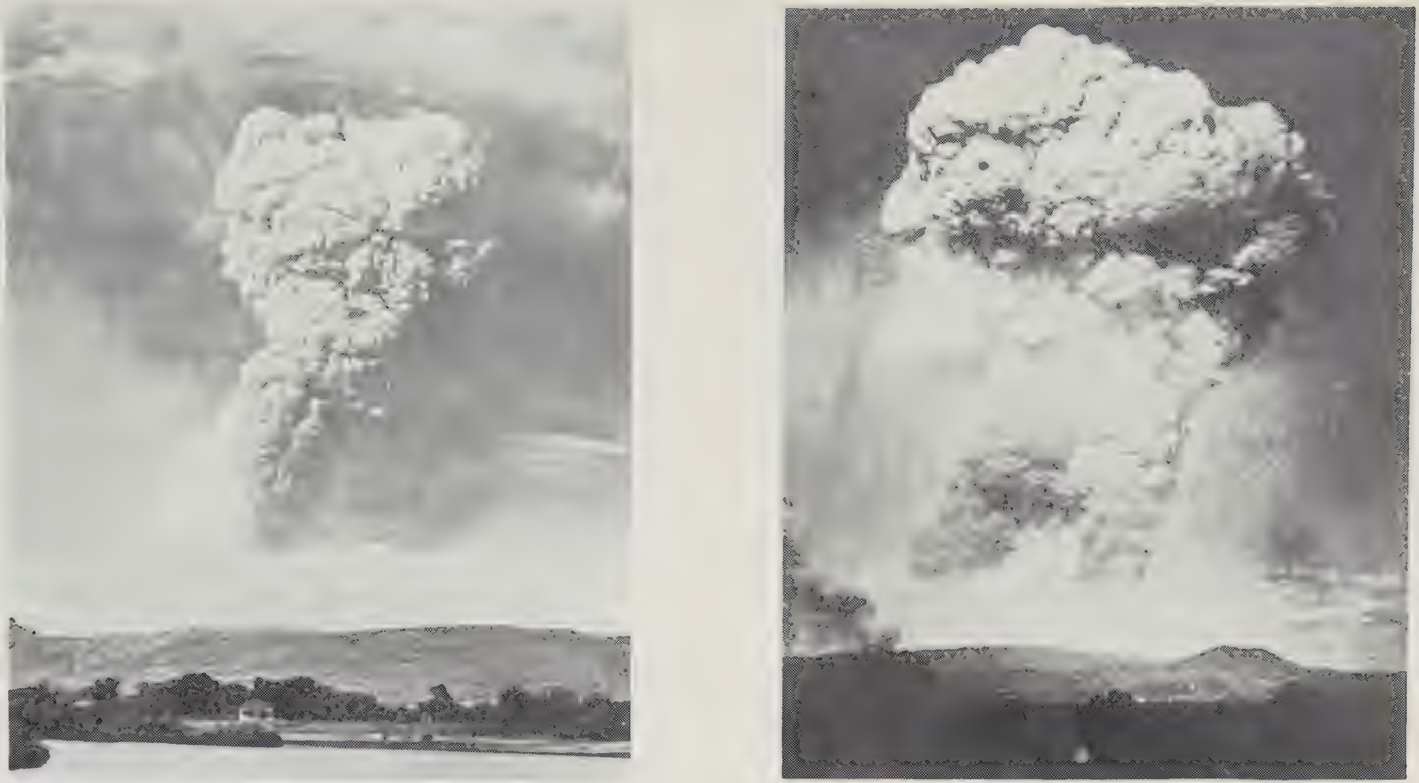

Fig. 31a. The great column of smoke as seen from Red Bluff. 36,000 feet high as measured from Red Bluff. Photo Stinson. (b) Double Face, viewed from Anderson, May 22, 1915. Photo R. I. Meyers.

Through driving rain and snow, we trudged back to Viola over these long, weary mountain miles after dark last night. When will we get out of here? I don't know, but that's a different story.

Just now, perhaps, the reader will be more interested in reading about mud. Mt. Lassen mud.

Yes, it's mud. Real, mucky, mushy mud. Its trail is probably almost thirty miles long.

It's grayish white mud. They have shown us bottles of ash, souvenirs gathered at the crater's mouth last summer. That dust was belched out of the volcano during the series of eruptions which followed the first eruption of Lassen within the memory of living men on May 30, last year. The ash dust looks like cement, and from what we have seen, it has some of the qualities of cement.

The mud which poured from Lassen's crater last Thursday night appears to be made up largely of this fine ash dust. In the wake of the flood in Lost Creek we found great logs of green pine, many of them three and a half feet in diameter, which had been completely peeled of bark by striking other trees and rocks during its rush down the canyon. After an immersion in the sea of mud, the logs came out encrusted with a thin layer of cement mud, as finely coated as any sanded pillar on a public building.

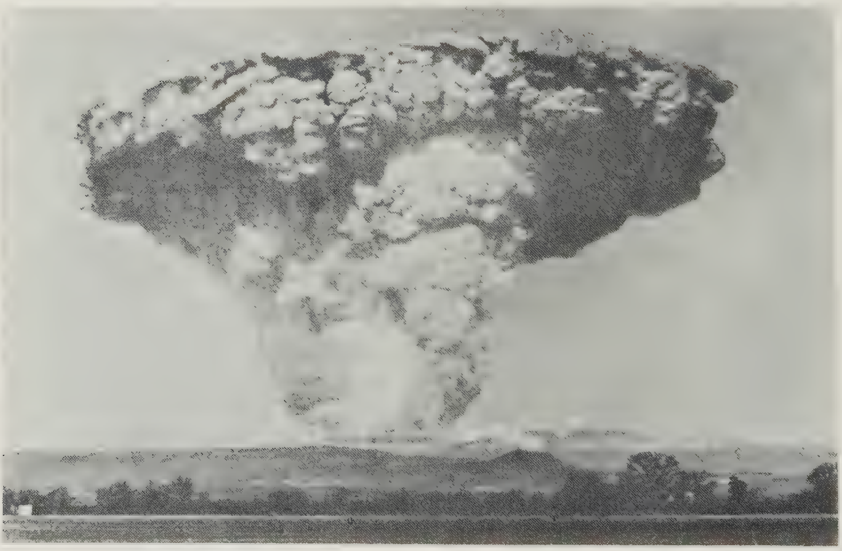

Fig. 32. The Big Umbrella, or Mushroom, Smoke Cloud, viewed from Anderson, fifty miles distant. Photo Meyers.

Lost Camp Lost

We hit Lost Creek at Lost Camp, or rather where Lost Camp used to be. Now it is truly lost.

Lost Camp was the mountain range used by A. J. Herbert. Fortunately, owing to the lateness of the season, he had not moved in for the summer, else he might not have been so fortunate as the family of Wid Hall, ten miles farther down from the peak, who escaped with their clothing after a forest ranger had dashed up and sounded the alarm of the onrushing flood.

We found parts of Herbert's house jammed in between two big pines in the middle of a big pond of hardening mud two hundred yards below the spot where it formerly stood.

Where the Mud Slushed

The sides of the gulch, where the mud had slushed up and receded, were covered with a thin layer of hardening mud. It had the appearance of a freshly laid cement sidewalk. We stepped out on it until the depth increased. Then our feet began to sink. We soon discovered that in order to cross the trail of mud we must keep to the logs.

Thirty Feet of Mud

As the little valley narrowed to a gorge, a great jam of logs collected, backing up the mud and sending it around to another outlet. Thus we found mud marks ten feet high on the trunks of trees, while only a hundred yards away the mud level was fully thirty feet lower. In spots the deposits must have been ten to fifteen feet deep. We didn't sound its depths.

About half way across the mud-strewn valley we saw a cloud of vapor. "It's a hot rock, imbedded in the mud," opined Kimball.

Doing Some Hopping

By hopping from log to log, stepping off now and then and miring almost to our knees, we finally reached the spot. Kimball was correct. It was a big hot boulder imbedded in the mud. The top of it was sticking up and the heat had dried the mud for several feet around it, making it safe for us to walk without keeping to the logs. There were bubble holes in the hardened mud, through which the heat had escaped.

We tapped the top of the boulder with a pair of pliers and broke away the cement-like incrustations. It was a great blue boulder like that from which basalt[12] blocks are made. And it was so hot that we could not hold our hands on it. The stream of shooting hot air blew dirt away as it fell over one of the vents. We were destined to find several hot rocks in that mud during the afternoon. This was on Sunday afternoon.

The eruption which tore them from the internals of Mt. Lassen and hurled them from the crater occurred some time Thursday night or Friday morning. And the rocks as we found them, still steaming hot, were ten miles below the summit of the peak.

Hat Creek Survivors

The names of the survivors of Hat Creek and Lost Creek filtered out to the world three days ago. The newspaper reading public knows of their losses, but the intimate details of Lassen's misbehavior probably have not been told as yet. We heard all kinds of stories on our way in. Most of them were based on speculation. Telephone lines were down and the news had been passed by word of mouth to Redding and Red Bluff, each story assuming new phases with each retelling.

Saw the Big Blow

We saw Saturday afternoon's eruption, the biggest yet, as we sped northward in our automobile from Stockton. We were about twenty miles above Lincoln when we sighted the great cloud of smoke in the northern horizon. It loomed suddenly and at first assumed a balloon shape, being seemingly tied to the mountain at the balloon's intake. The western side of the balloon stood out bright in the sunlight. The folds of ash colored smoke resembled nothing so closely as the curly folds of a sheep's wool, newly shorn.

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[12] The 1915 lava was however not basalt; it was instead a rock richer in silica known as a dacite.

The Courier Free Press of Redding reports:

> Last week, Professor R. S. Holway, of the University of California, professor of physical geography, ascended to Lassen crater. He was the first man to reach the crater since the mighty eruption of May 20th[13] and 22nd. Holway ascended the mountain from Mineral Station, on the south side. The ascent from this direction is much easier than from the north side.
>
> On his return from the crater, Holway gave out an interview in which he is quoted as saying that he saw nothing to justify the assertion that the mud which swept down Lost Creek and Hat Creek actually came out of Lassen crater. His theory was that the ashes from the volcano melted the snow about the crater, and the water, rushing down the side of the mountain, caused a big slide[14].
>
> Subsequently to Holway's visit, Fred Seaborn, a Forest Ranger who is stationed in Hat Creek valley, near the base of Lassen, ascended to the crater from the north side. Seaborn climbed the mud trail to the crater, and the press reports quote him as declaring very positively that the mud actually flowed out of the low end of the crater on the northeast side[15].
>
> While the members of the Record expedition did not reach the crater, they crossed the trail of the mud flow and saw that it extended directly to the crater. The trail of mud cut into the side of the mountain. Snow on both sides of the mud trail was not melted. This seems to dispel the hot ash theory.
>
> Forest Ranger Seaborn does not believe that Professor Holway saw the lower end of the crater or the track of the mud down the northeast side. Samples of the mud found in Hat Creek have been submitted to experts in San Francisco and they have pronounced it to be volcanic mud[16].

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[13] The eruption of May 19th is referred to—it did occur during the night of May 19-20 although the full impact of its results were not generally felt and known until daylight of the 20th.

[14] The view held today by geologists is that it was not heat from the ash which melted the snow, but rather heat from the newly erupted lava and condensed steam.

[15] It may well be that some pulverized volcanic ash mixed with melted snow or with condensed steam spilled over the crater lip.

[16] The name "volcanic mud" does not imply that the mud originated inside the volcanic crater.

I will reserve my argument for the present, as to how and where the water came from which produced the great mud flow down Lost and Hat Creeks. And while we are waiting for Professor Diller to make his second visit to the Lassen volcano, we may enjoy ourselves looking at some of the photographs of the great eruption of May 22, 1915. For while I failed to get a shot at the great smoke cloud, on account of having used up all my dry plates, there were several others who were more fortunate and secured some very nice pictures for this work.

On May 24, three of us men, Dock Gregg, another party and myself, went up the mountain to see what the result was of the recent great eruption, and also to see if it was possible for the flood to get into Bailey Creek, and then come down to Viola. When we reached the lakes, we saw four streaks running down the mountain which marked the trails of the recent mud flows on our western front. Going south from Manzanita Lake, we climbed to near the top of that unnamed mountain to the west of Lassen Peak[17]. We found about five feet of snow near the top of this mountain, but the snow was hard so we could walk over the

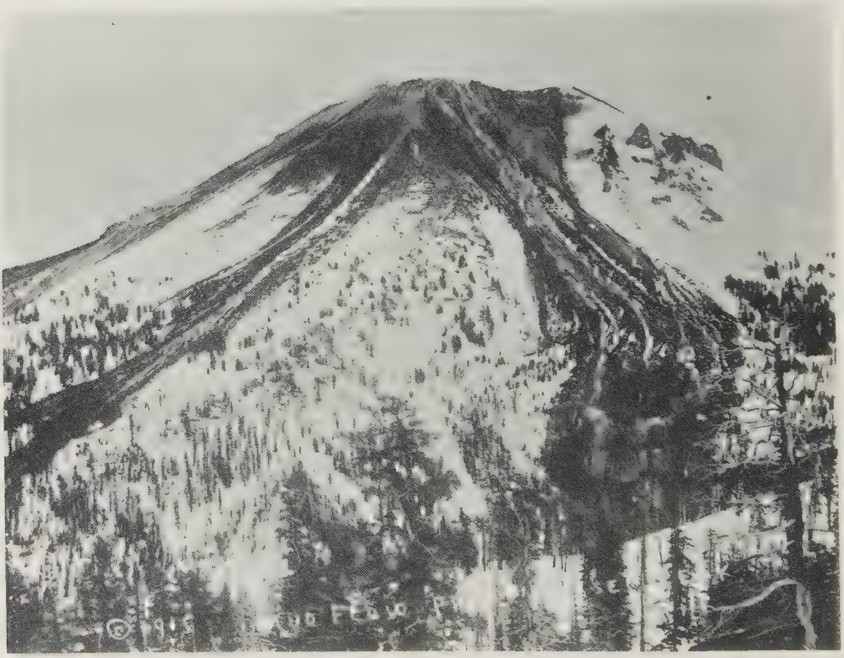

Fig. 33. The mud flow on the west side of Lassen Peak. Four streams of mud flowed down into Manzanita Lake. Only three are visible here as one was NE behind the shoulder to the left. When this picture was published, it was universally agreed that we had a genuine volcano. Notice the new lava at the top of the peak.

---

[17] This mountain is now officially known as Loomis Peak in honor of the author.

top of it very well. From this elevated view I got the picture represented in fig. 33.

When this picture was sent to the newspapers, they all gave it up and said we had a genuine volcano. They had been quite doubtful about it before this happened, but not afterward. One of the four streaks is around the peak to the left, and is lost to view from this view point.

We learned that it would be impossible for the flood to reach Viola from Lassen Peak, as it would have to cross the head of Manzanita Creek to get there. However, the greater part of the mud flow on the west side ran out on top of the snow, while the water disappeared in the snow, and this prevented the greater part of the mud flow from reaching the lake. Manzanita Lake is filling very fast these days on account of there being a constant wash of sandy material of the light pumice variety into the lake whenever the flow of water is very much above low water mark.

While we were standing there, on two occasions a large rock came loose from the new lava at the top of the peak and came rolling down the mountain, and when they struck the snow at the foot of the mountain, they were so hot that they sent up a cloud of steam like an eruption.

I learned later that these rocks cooled so quickly that they cracked and broke up into rather small pieces, and the pieces are lying there now all in a heap. One of these rot rocks was perhaps fifteen feet in diameter. This rock pile is shown in fig. 34.

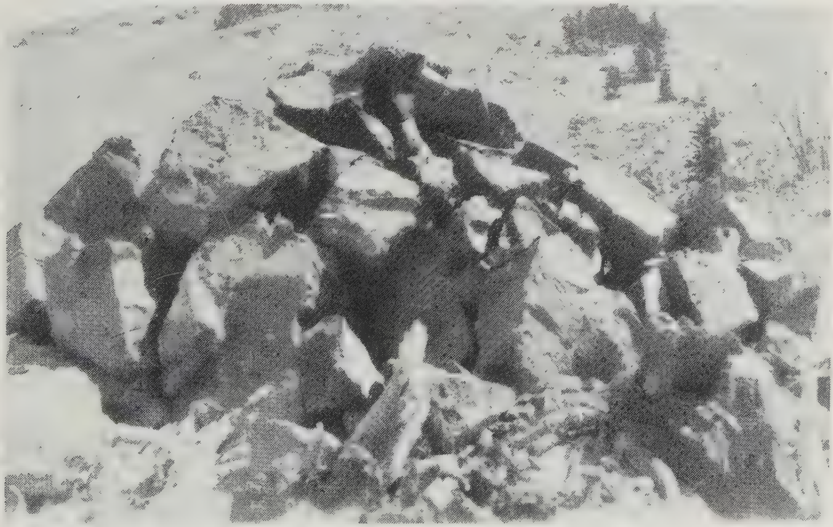

Fig. 34. Hot Rock. Broken in pieces while cooling.

PROFESSOR DILLER'S SECOND VISIT TO THE VOLCANO

It was early in July, 1915, that Mr. Diller made his second visit to the volcano. He came direct to our house at Viola, and the next morning he and I went over the hill to Lost Creek.

Some of the men in our mill crew had been over there, Ed Wilson, in particular, and had told me that a considerable amount of timber had been blown down on the head of Lost and Hat Creeks, but I had not been there myself since the day of the second great eruption of May 22. I had only been as far up as the large hot rock on Lost Creek at the northern Park boundary[18] of the Lassen National Park. We went to about a mile beyond Manzanita Lake with an automobile, which was as far as we could go with a machine at that time, then from here we went the rest of the way on foot. A fairly good road is now made so that one can go all the way to the head of Lost Creek with automobile.

THE DEVASTATED AREA

Could I believe my eyes? I had intended to tell Mr. Diller how the trees were battered up in the mud flow of May 19th, but when we reached the head of Lost Creek we found the trees all blown down. In the second great eruption of May 22nd, a hot blast of steam had shot

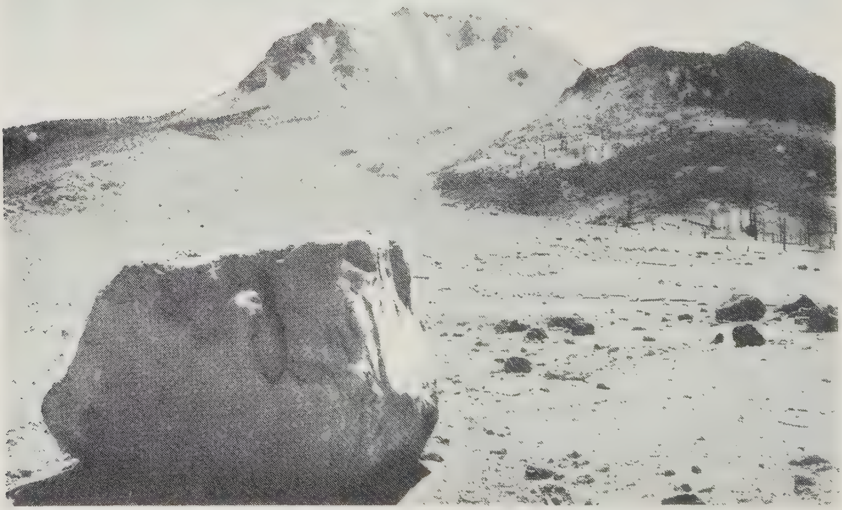

Fig. 35. View of Lassen Peak from Hot Rock after the blast of May 22, showing timber blown down, that was still standing after the mud flow of May 19 as seen in Fig. 22, both pictures taken from same viewpoint.

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[18] This is the old Park boundary, the northern limits of which have been extended to include a considerable part of the Lost Creek area.

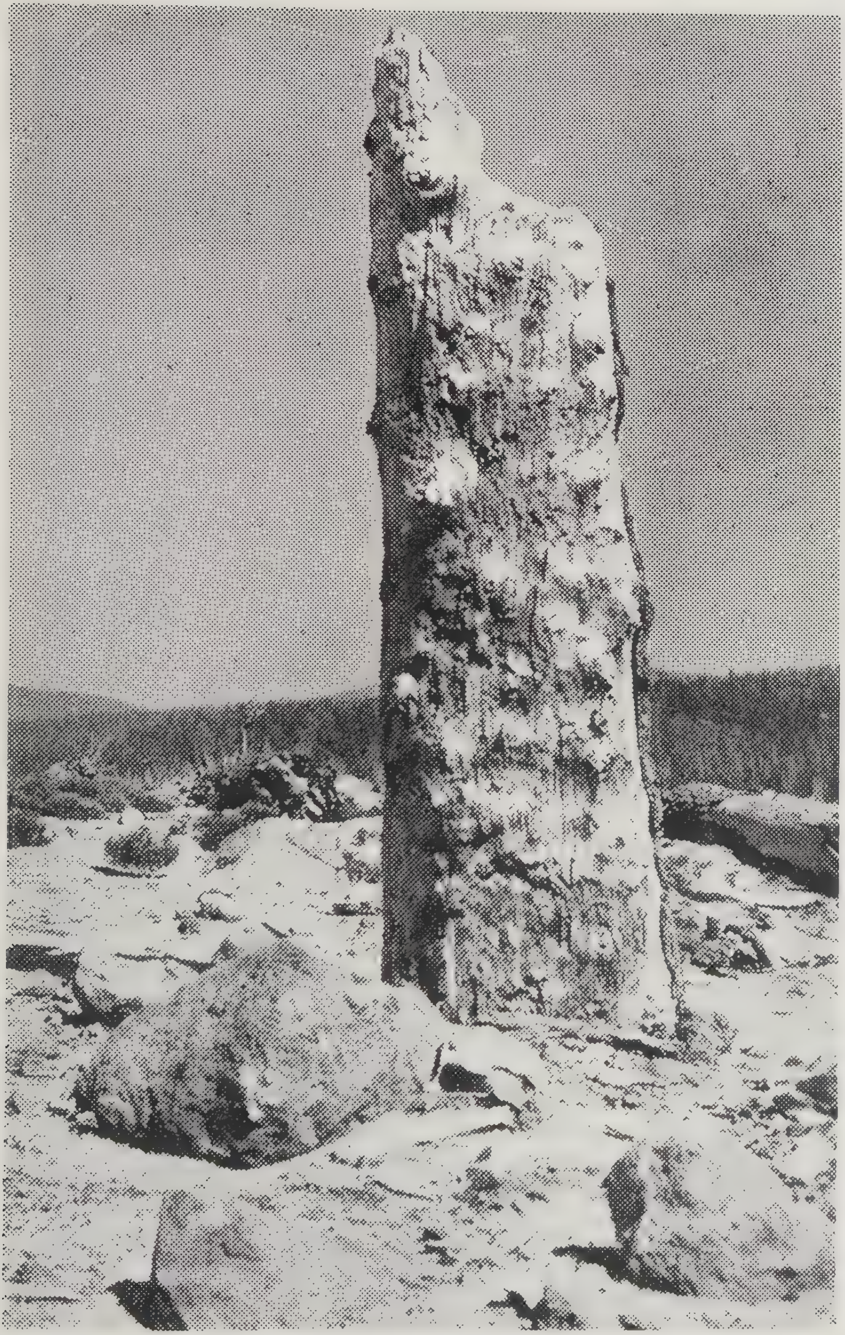

Fig. 36a. Two views of snags battered by mud flow, then broken off later by hot blast from volcano. Notice one tree is 65 feet from the stump.

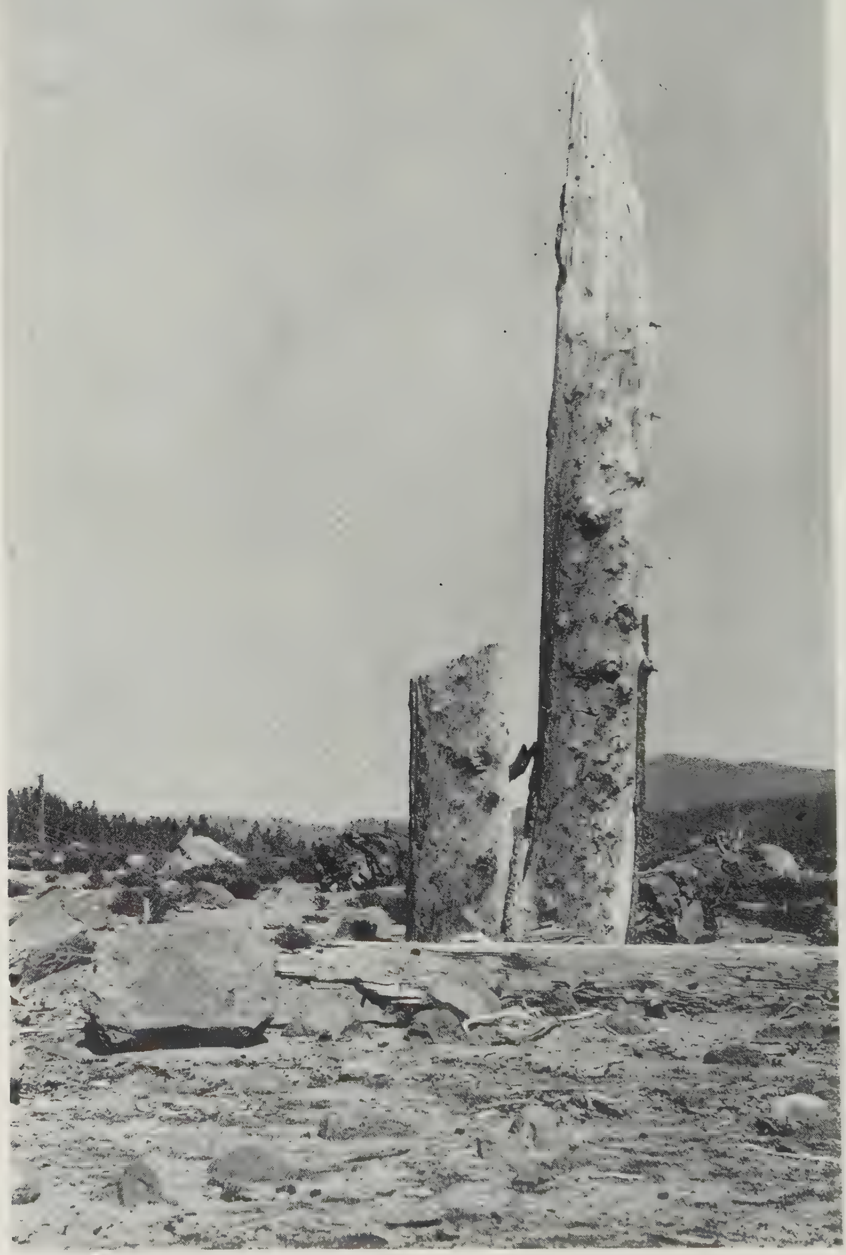

Fig. 36b. This was the deepest part of the mud flow going into Hat Creek, and also the center of the hot blast of May 22.

down across the heads of Lost and Hat Creeks and had blown down all the timber for a space about a mile and a quarter wide, and away down across the head of Hat Creek (Fig. 35).

The trees, although they were all lying down, showed on their upper side where the mud flow of the 19th had battered the bark all off, and scarred the wood, as they were before the second blast. I called Mr. Diller's attention to the fact that no trees had been blown down in the first mud flow, which was all mud flow, and no evidence of a horizontal blast. It seems that the first big eruption formed a lid[19] over the top of the mountain, and as it had torn a great gash on the east side, the hot steam shot out as a horizontal blast and had blown down all this belt of timber. In one place, near the top of the cliffs to the east of Lost Creek, a small fire had been set, presumably by the blast, in which, perhaps, a hot rock had been thrown over there, but it was early in the season and the fire did not run more than a few yards when it went out.

The first sight to greet our eyes after reaching the flat above the Cold Spring[20], was the trees to the left on the steep hillside were all thrown over against the side of the mountain. They all pointed in one direction, up the hill[21], as seen in fig. 41.

Then all those trees on the divide between Lost and Hat Creeks were all blown over. One of these large trees, nearly four feet in diame-

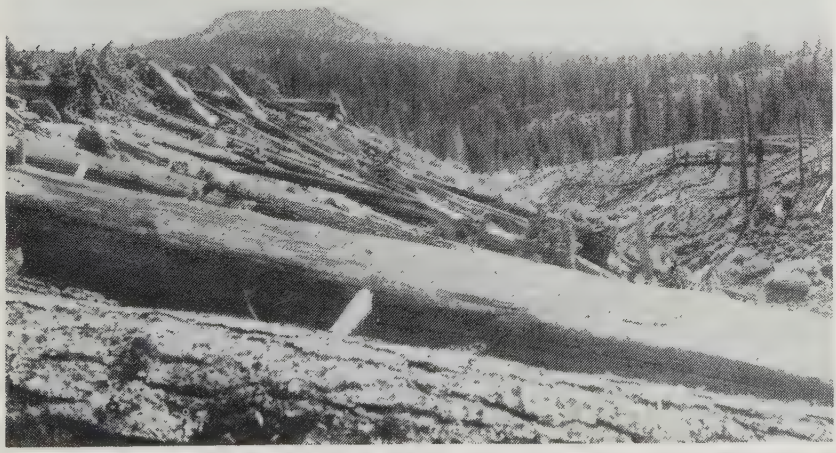

Fig 37. Scene in devasted area, looking toward Hat Mountain. All this timber was blown down by hot blast from the volcano.

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[19] The hardened lava flow in the summit crater.

[20] Presumably what is now known as Old Boundary Springs.

[21] The west flank of Raker Peak.

ter, in the center of the blast was broken off about eight feet above the ground, and the tree was carried about sixty-five feet from the stump. Something more than hurricane force obtained here. This is shown in fig. 36.

It was estimated by the Forest Service that between four and a half to five million feet of timber were destroyed by the mud flow and the hot steam blast. The accompanying photographs tell the story much better than any pen picture could describe it (Fig. 37-40).

After viewing the fallen timber area, we went around to the foot of Lassen where the flood had come down the steep hillside, and there we discovered quite a number of "craterlets." These craterlets are formed by hot rocks being buried in the mud. These were covered by perhaps six or eight feet of mud. The steam from these hot rocks blows the mud away from above them, forming inverted cones, as seen in fig. 42. These craterlets were still steaming, something over six weeks after the eruption.

The second mud flow from the eruption of May 22 was not so large as the previous one from May 19th. Furthermore, the greater part of the loose debris was washed away, so that the second flow was more water and less mud. It was decidedly less in quantity, and much more fluid. Near the edge of where the flow came down at the foot of the

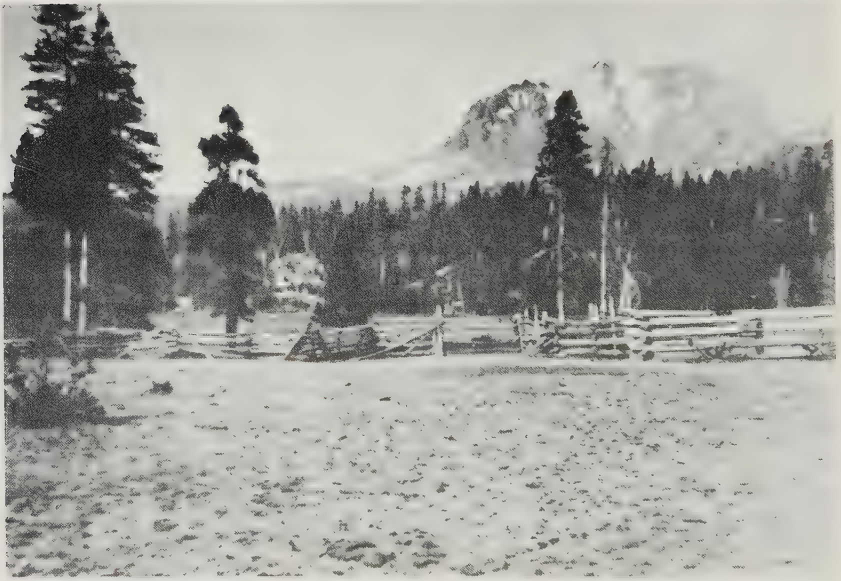

Fig. 38. Jessen Meadow before the flood, August 1910. It was then a fertile meadow furnishing feed for fifty head of cattle, while they were gathering up their beef in the fall.

Peak, we found some pure volcanic ash on the rocks to the depth of about two inches, and I gathered up a chunk of this, and sent it down to the State Mining Bureau at San Francisco. This concluded our first visit to the devastated area, then we retraced our steps for home.

When we reached Viola, Professor Diller had a telephone call from Dr. Arthur L. Day. He was across the mountain at Mineral, and they arranged to meet up on the mountain somewhere the next day, so I did not accompany them. The next evening, however, I received a phone call that they each wanted a full set of my photographs, to be made up at once, and they arranged to come to Viola a day or two later.

When they came they remained with us two nights. Dr. Day is one of those jovial good fellows, very communicative, and while there he would sit out on the porch with the mill men gathered around and talk volcano. If you asked him a question, he would not only answer the question, but would continue and tell much more along the line of your inquiry. Everybody enjoyed his visit here. Since then, he and Mr. E. T. Allen have written a book on "The Volcanic Activity and Hot Springs of Lassen Peak." This book is published by the Carnegie Institute, at Washington, D.C. It is a great work.

The next morning after their arrival, Dr. Day and Professor Diller and myself took another trip into the Lassen Peak region. At the foot

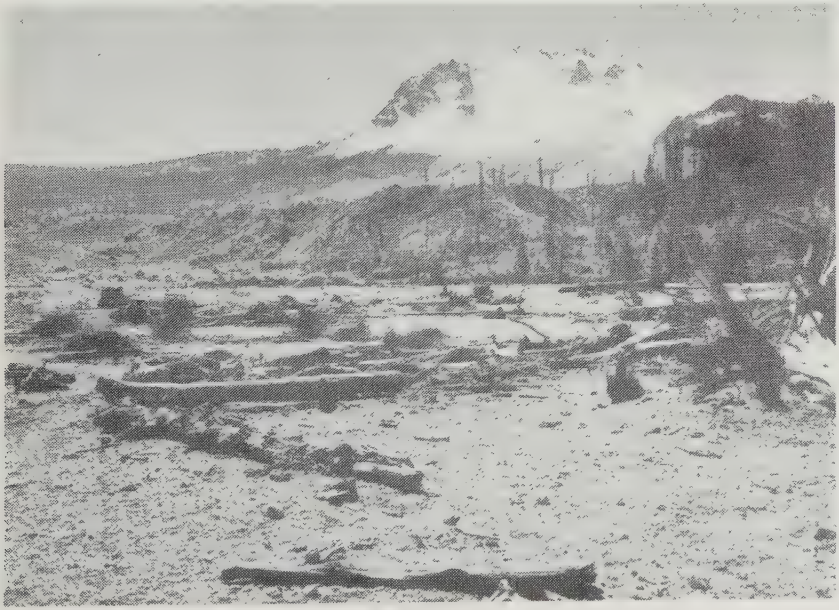

Fig. 39 Jessen Meadow after the flood and hot blast, taken in 1925, from same viewpoint as fig. 38, showing devastation. Notice all the timber in fig. 38 is all wiped out in this view by hot blast from volcano.

of the Peak, on the divide between Lassen and Chaos Crags, we found a considerable quantity of "pumice and bombs," that were evidently thrown out of the crater in the recent two great eruptions. Many of these were broken by the fall, as they appeared to have been thrown to this place before striking the ground, and they showed no sign of being in a fused condition, and therefore, evidently, not so very hot. We also found near this place a piece of "volcanic glass," otherwise known as "obsidian," about two feet diameter. I imagine this is the material the Indians made their arrow heads from, as they seem to have a similar appearance, so far as the material is concerned[22].

Before leaving, Professor Diller expressed the opinion that Lassen volcano had done its worst, and that it would now die down. Dr. Day was not so sure about it, and said if the volcano was possessed of certain chemical elements, it was likely to continue for some time. He gathered up some of the ejected materials and sent them on to Washington for analysis, but I never heard what their conclusions were, but they are in-

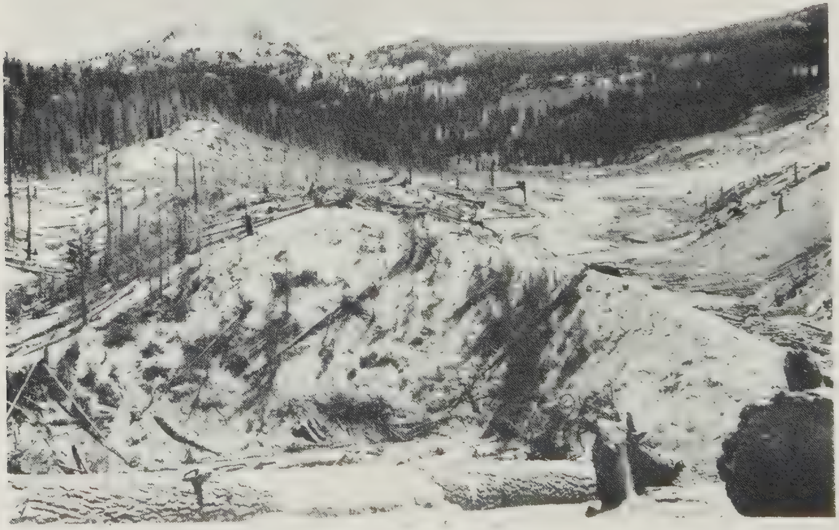

Fig.40. Scene in devastated area, looking south, up Hat Creek. Lassen Park Road crosses Hat Creek just below Hat Lake seen in the distance, then passes through devastation to the left.

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[22] Local Indians did use obsidian for making arrowheads, however, it was probably obtained from the Burney-Shasta area, as true obsidian is practically unknown near Lassen.

cluded in his book. Professor Diller's opinions were expressed as reported in the Weekly Chronicle under date of July 26th as follows:

> Mount Lassen, California's now famous volcano, the only one within the borders of the United States[23], is tiring out. He's done his worst in the brief fourteen months of his fiery spree of 107 distinct tipplings, and, according to Professor J. S. Diller of the United States Geological Survey, he's drifting rapidly into harmless senility.
>
> Nobody in the world knows more about Lassen than does Professor Diller. He it was who, in 1891, climbed the peak and studied the volcanic activity on its sides and in the Cinder Cone regions, and it was he who reported then that the mountain was not so quiescent that another eruption was impossible.
>
> In June a year ago, within three weeks after the supposedly extinct crater on top had belched forth in new life, Professor Diller climbed the peak and made a report, settling

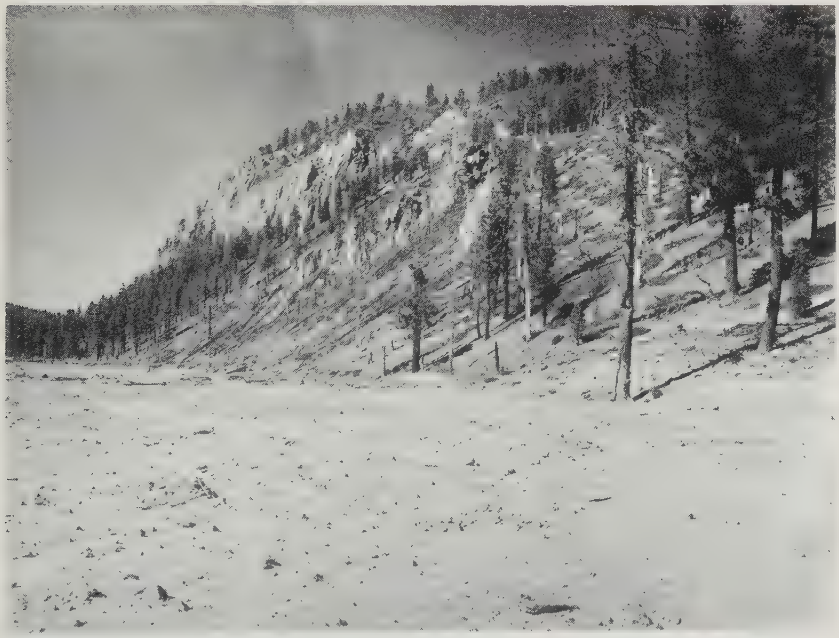

Fig. 41. Trees blown against the hill side by hot blast from Lassen Peak. Looking down Lost Creek to the left, the flat land was covered with grass and willows before the flood. (The Lassen Park Road now goes near the foot of this mountain named Raker Peak.)

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[23] There are active volcanoes in Hawaii and Alaska.

once for all whether or not the phenomena was geyser-like or actually volcanic.

According to Professor Diller, the climax in Lassen's periodical tantrums came in the tremendous outburst of May 22nd last—an eruption which easily exceeded in fury all previous ones. This was the awe-inspiring occasion when, from the top of the mountain, following three concurrent eruptions of rock, smoke and steam, four huge rivers of mud poured down the north slopes of the peak, rushing in a flood into Hat Creek valley and devastating that peaceful valley in an orgy of ooze.

That remarkable outburst, says Professor Diller, was the culmination of Lassen's brief career as a revived volcano. The peak is not dead, he observes, but dying.

There is still much activitiy about the summit. True, the two craters, which developed at the very top, are clogged up, but fissures down the northern and western sides emit gasses, smoke and steam in intermittent puffs. Professor Diller noted on his recent visit to the peak, that these exuda-

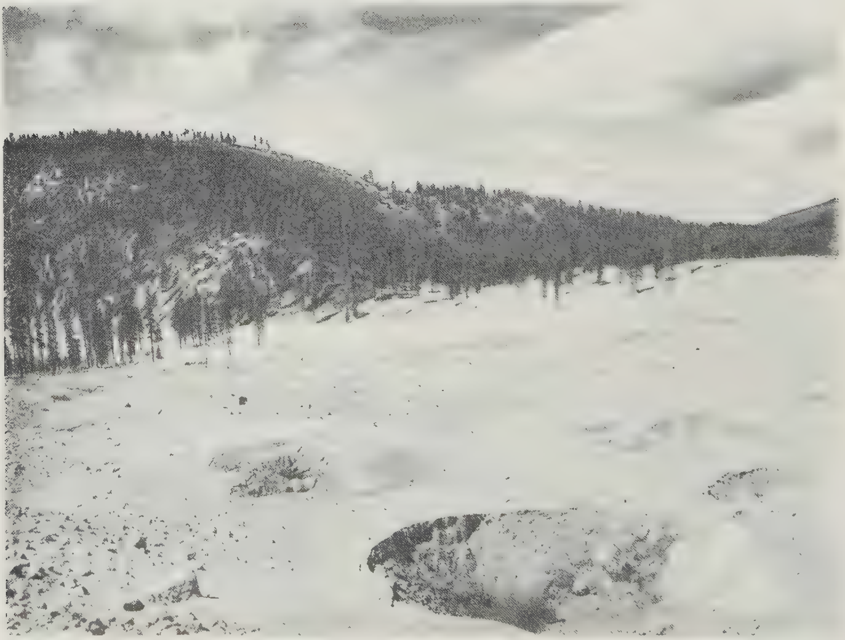

Fig. 42. "Craterlets," at the base of Lassen Peak. Hot rocks were buried in the mud, and the steam from them blew out these holes, like inverted cones. They were still steaming over six weeks after the eruption. Some of the rocks to the left were covered with volcanic ash.

> tions were diminishing appreciably, and all indications led him to form the opinion that the volcano was in an obvious decline.
>
> As a prophet, Professor Diller has established himself, at least so far as Lassen Peak is concerned. When he made the trip to the volcano a year ago he predicted that the mountain would grow more violent, and he issued a warning to the people in the neighborhood to 'look out.'
>
> On more than one occasion the treacherous old volcano surprised sightseers by belching a flood of rock, smoke and gas in their faces, and several lives were nearly snuffed out thereby. Up to the present time, however, the mountain has caused the death of no one, being at least a jovial old topper.

During the latter part of Lassen's activity a new crater developed on the north side of the peak. This crater was decidedly enlarged during the great eruptions of May, but in the first of these no mud flow came down on the north side, but in the second great eruption on May 22, four mud streams came down on the north and west sides, and one of these coming down from the north crater. In fig. 43 the steam is seen coming from the north crater. This picture was taken in July, 1915.

Mr. Chester Mullen, a photographer of Redding, was determined

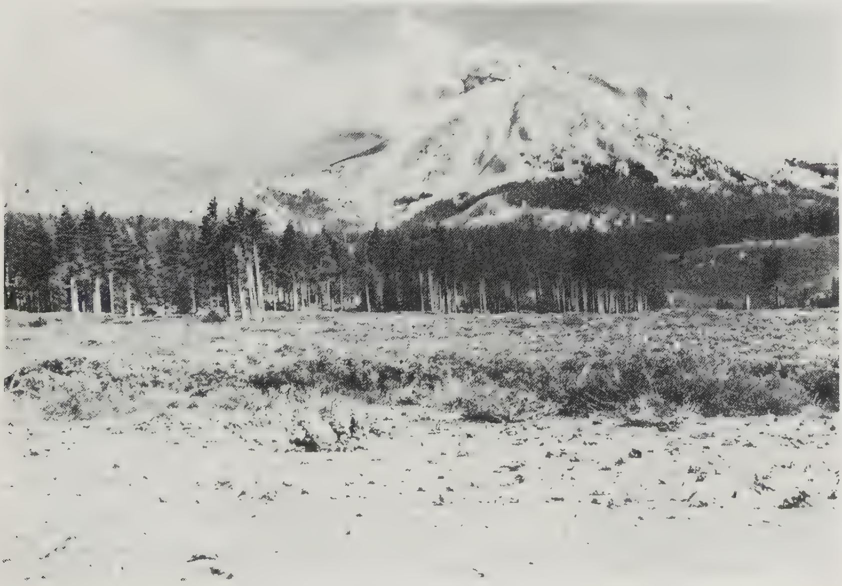

Fig. 43. Lassen steaming after an eruption, July 1915.
Steam coming from north crater.

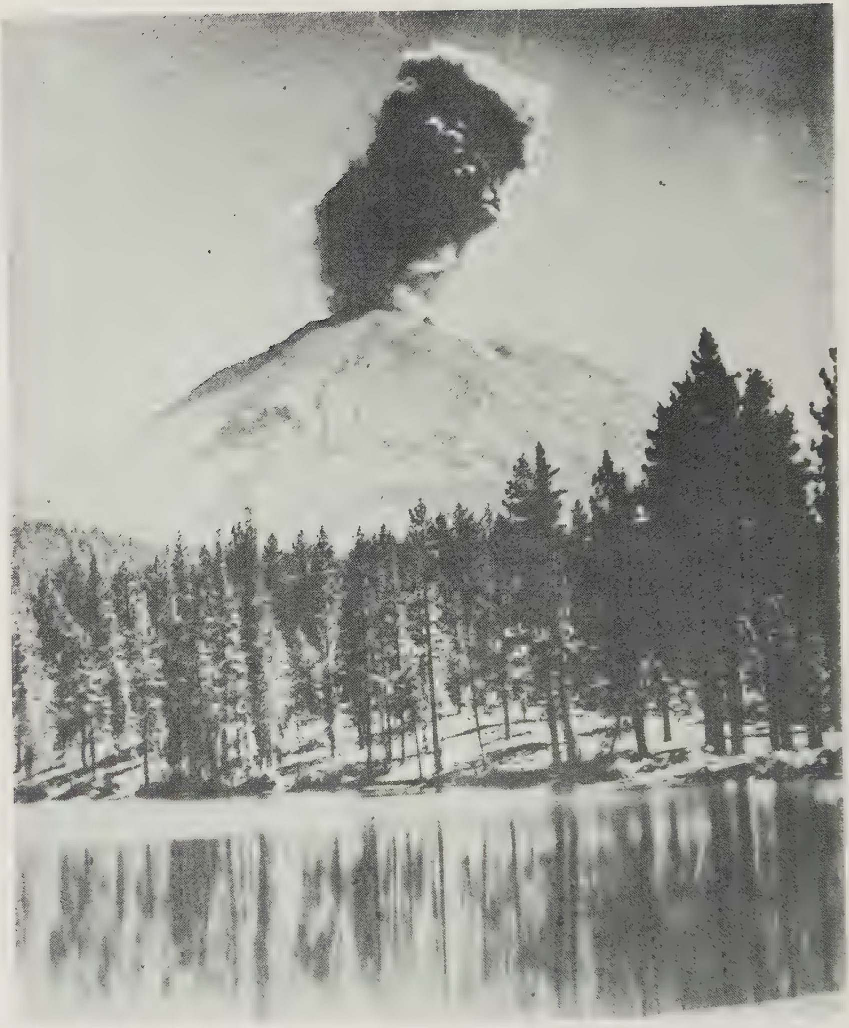

Fig. 44a. Four successive views of Lassen in eruption, October 6, 1915. Notice the fourth view shows a second puff. Photos Chester Mullen. (Continued on next 3 pages)

to get some pictures of Lassen in eruption, and made his camp at Reflection Lake for a week or two at a time, and finally his vigilance was rewarded with success. On October 6, he secured a series of four very beautiful views of Lassen in eruption. These are shown in fig. 44.

Mr. W. S. Valentine, a professional photographer at Redding, also secured several very nice views of Lassen in eruption, two of which are presented here (Fig. 45). One of these seems to have come from the crater with a twist. Mr. Valentine had an enlargement of this picture

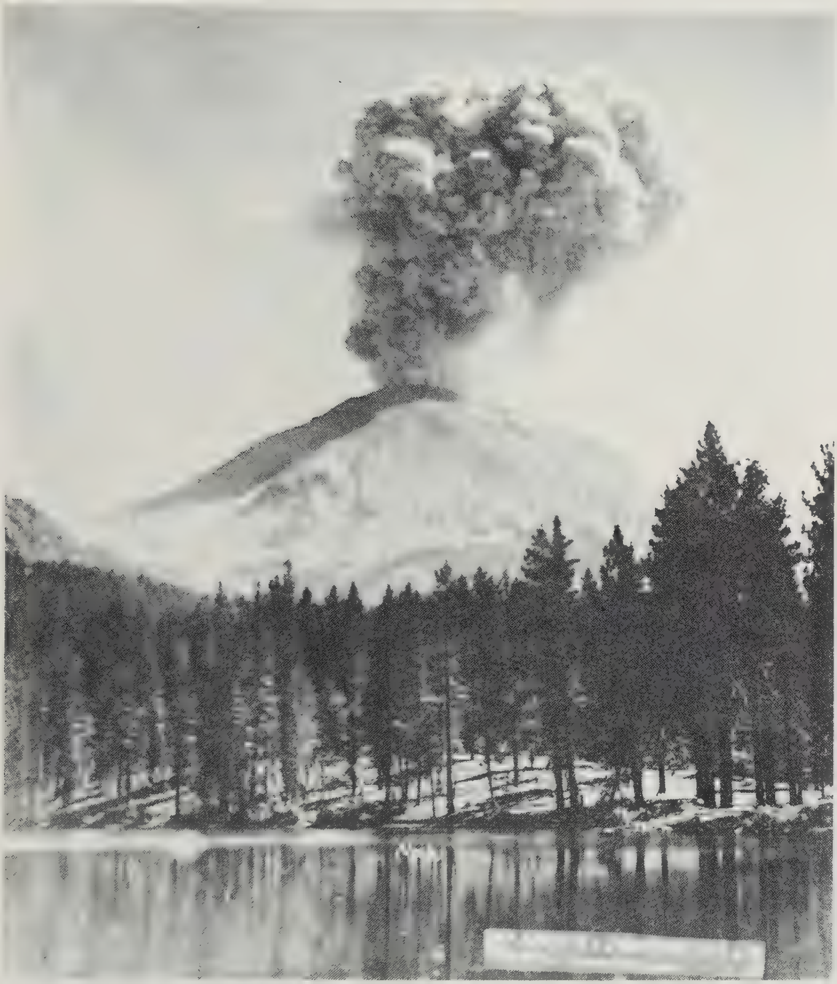

Fig. 44b.

on a banner which was displayed at the Panama Pacific Exposition at San Francisco on Shasta County Day, and the picture attracted considerable attention.

It was from the Valentine Studio that my first pictures of the volcano were sent out to the newspapers, and the Valentine Studio became Redding headquarters for my Lassen views for some time after that.

It was some time in July, 1915, that Mrs. Loomis and I went up to get a view of Lassen in eruption from Reflection Lake. All our former views had been taken from the manzanita chute, a road through the manzanita brush thicket, and we desired to get a picture with the lake for a foreground. On this occasion the volcano was in light eruption all

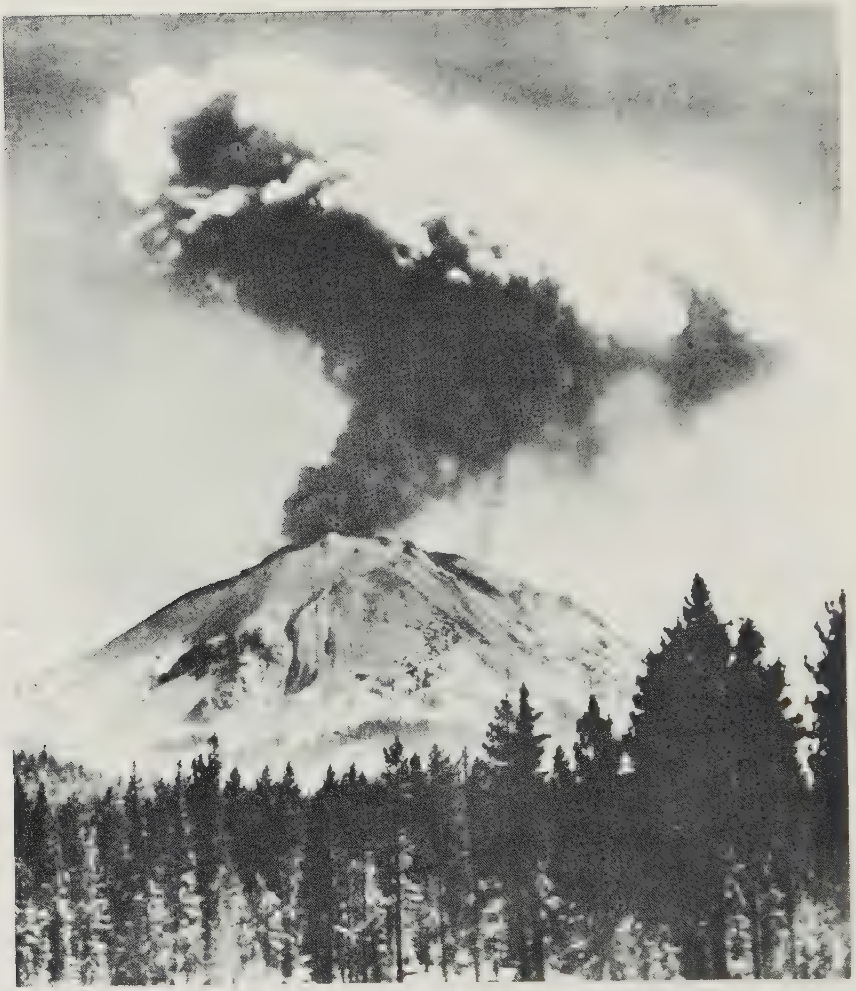

Fig. 44c.

the time we were there; or as I expressed it at the time: "Lassen is taking a long smooth smoke." We had been waiting there for two or three hours, with no change, and desiring to get an eruption picture from the lake any way, I "took his picture," but as it was a very small eruption I thought but little of it and never made a print from it for several years. But after the volcano had died out, I ran across the negative again one day, and, while it was a hard printer, I made a picture from it, and we now prize this picture above all others in our collection. The picture appears as Frontispiece in this little volume.

By noticing this picture you can see where the mud streams ran down through the snow. One of these comes direct from the north crater;

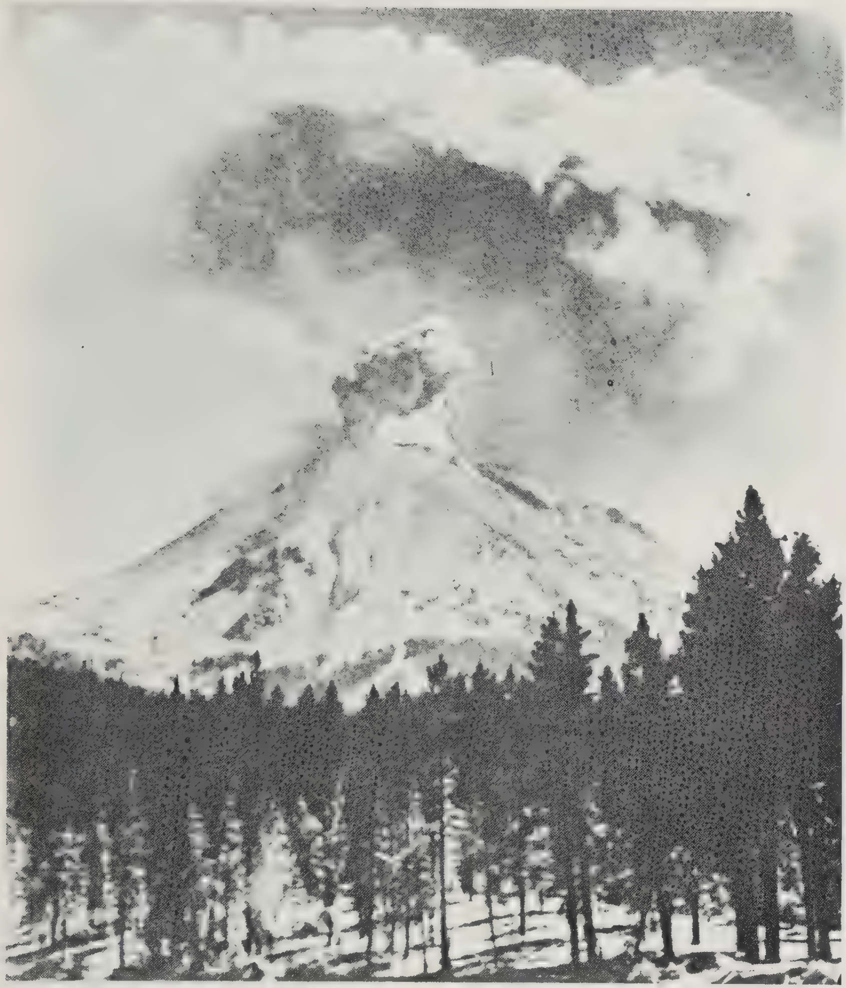

Fig. 44d.

others to the northwest and west, while one stream is east of the north crater. All the mud streams seen from this viewpoint, ran down into Manzanita Lake. Reflection Lake has no inlet[24], but it has a slight overflow in the early spring, while the creek runs into Manzanita Lake.

Last summer, 1925, we built a road from Manzanita Lake to the foot of Lassen Peak on the west side at the Crescent Cliffs, nearly four miles above the lake. And from this point we built a foot trail to the

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[24] Before the area was made a National Park, a portion of Manzanita Creek was diverted into Reflection Lake so that at the present time a small creek does enter the lake and this overflows into Manzanita Lake.

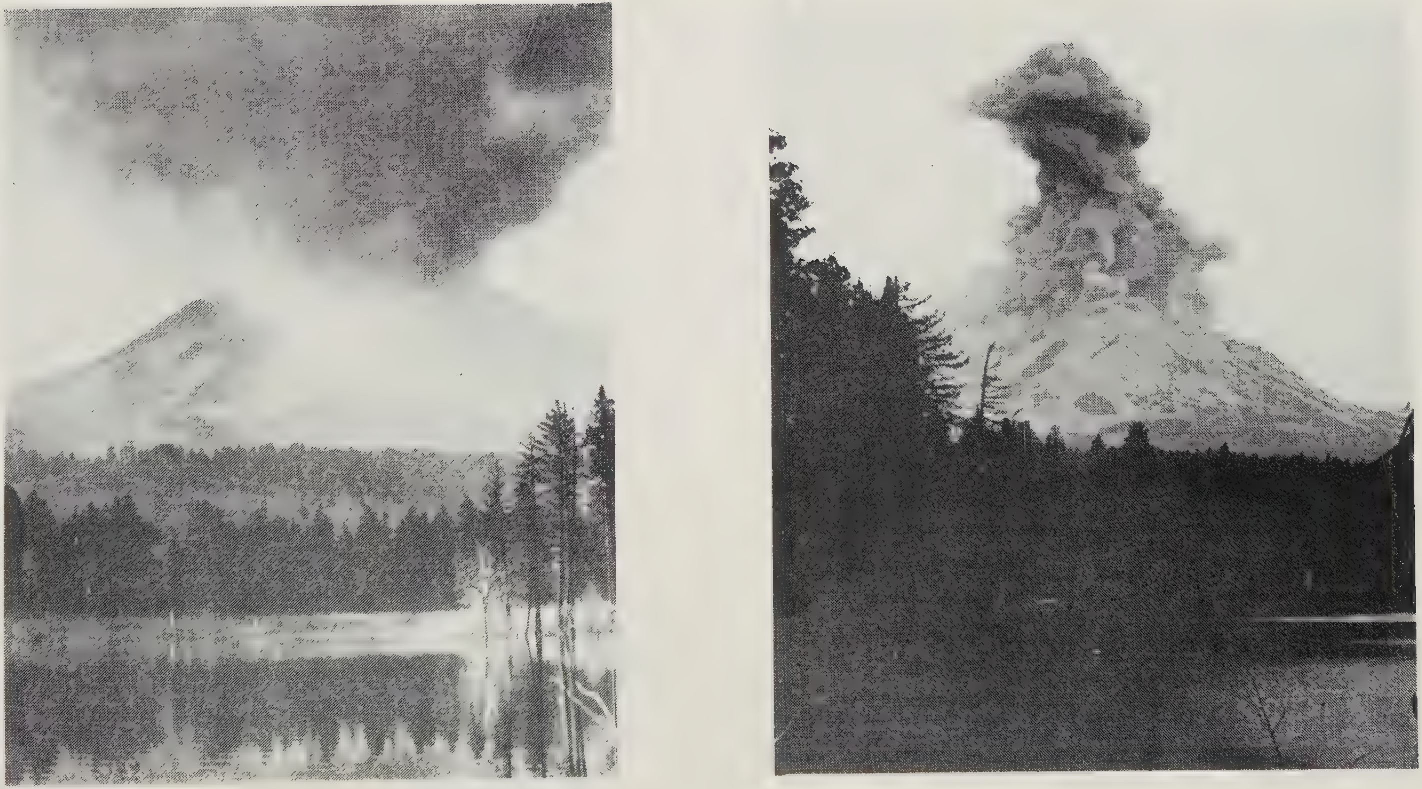

Fig. 45. Two views of Lassen in eruption. Photo Valentine.

top of Lassen Peak, a distance of something over two miles by the trail.

At the Crescent Cliffs is a terminal moraine about 300 feet high, so that road cannot be made any farther up Manzanita Creek without grading around the moraine.

The end of our road is in the grove of trees at the left in fig. 46. Our new trail begins here, going to the left of the eastern end of the cliffs, then goes straight up on the northern side of the mud flow. It crosses the lower end of the new lava seen at the top of the Peak, then enters the crater through the notch to the right of the new lava.

The mud flow as seen in fig. 33, came down through the ravine below the new lava, and poured down over the Crescent Cliffs then turned left at the lower end of the picture. Two branches of Manzanita Creek are seen in the foreground.

Going up the trail to the new lava flow, in crossing the lower end of this lava, it is seen to be a semi-porous rock, which is very rough and craggy. That this mass of lava was hot on the night of the great eruptions is evident from the fact that a portion of this lava flow and the glow from the volcano were seen by several witnesses at Volta twenty miles away. I also saw hot rocks roll down the mountain side from this tongue of lava on May 24, 1915[25], as before stated. Fig 47 also shows the mass was continuous to a large degree, although not to the degree of being molten[26]. Many of the rocks have the appearance of being mashed into each other, being partly fused. This new lava is a blackish rock known as dacite.

Reaching the top of the lava flow, we come to the pinnacles it formed as seen in fig. 49. The new lava at this point is perhaps fifty feet deep. I showed a sample of this rock to Dr. T. A. Jaggar of the Hawaiian Volcano Observatory of Hawaii National Park. He pronounced it to be "aa."[27]

Mr. G. R. Milford, in his letter to Professor Diller, thus describes the new lava flow on the west side of Lassen Peak:

> About 9:15 p.m. word was sent in by telephone that Lassen Peak was in eruption and fire could be seen coming from the crater. In company with Mr. and Mrs. Charles R. Milford, Miss Catherine Milford, Mrs. C. E. Johnson, Mr. and Mrs. F. A. Dooley, and Mr. and Mrs. George Risley, the writer went to a point of vantage about a hundred yards southeast of the power house where an unobstructed view of

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[25] Two days after the flow ceased advancing down the west side of the mountain.

[26] If not truly fluid, at least the flow was a viscous mass. The discontinuities represent cracking as the hardening lava continued to move.

[27] "Aa" is a Hawaiian term now generally applied to rough blocky lava flows, a condition resulting from a stirring action which causes the molten material to lose its contained gases with a corresponding loss of fluidity.

the peak could be had, and there found the reports were true and that the mountain was in eruption and fire[28] could be observed coming from the crater.

Our attention was first drawn to the deep red glow which appeared over the crater and was of sufficient intensity to illumine the entire outline of the mountain top. There was no moon, the heavens were clear, yet this glow was bright enough to be reflected in the dense clouds of steam and smoke arising from the crater. From time to time the glow seemed to change in brilliancy, now brighter, now dimmer—this variation due, no doubt, to the varying density of the clouds of steam and smoke issuing from the crater.

As we continued to gaze at the wonderful spectacle, the glow commenced to increase in brilliancy, now brighter, now still brighter, until, behold, the whole rim of the crater facing us was marked by a bright-red fiery line which wavered for an instant and then, in a deep red sheet, broke over the lower part of the lip and was lost to sight for a moment, only to reappear in the form of countless red globules of fire about

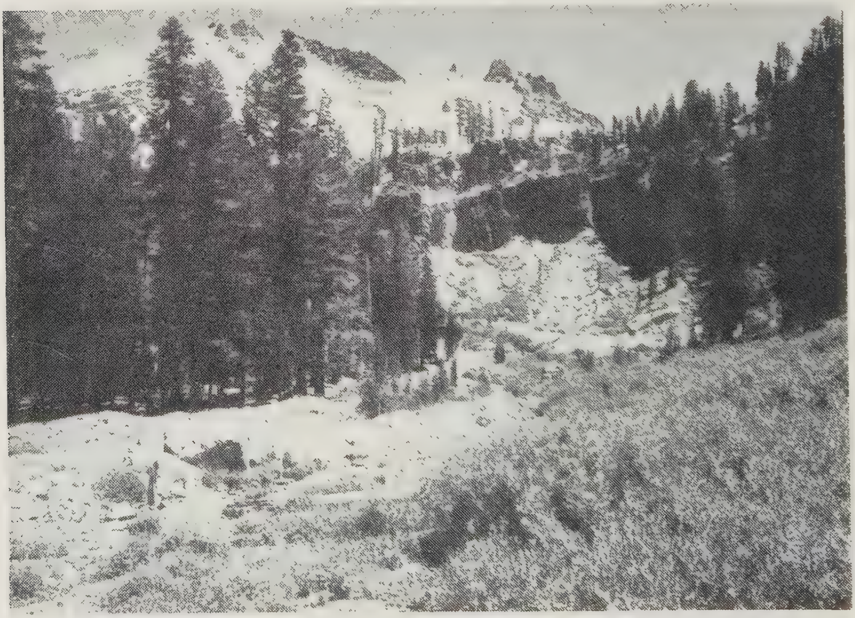

Fig. 46. Lassen Peak from Crescent Cliffs, showing mud flow. Notice new lava at top of peak. Mud flow came over the cliffs and is several feet deep at the left.

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[28] It is doubtful that true flames were seen. The glow of lava heated to incandescence is often reported as fire by the untrained observer. Temperatures of more than 1800°F. are not uncommon.

500 feet below the crater's lip. These globules, or balls of fire[29], were of varying size, the largest appeared at the distance (21 miles) about 3 feet in diameter, the smallest appeared as tiny red sparks. All maintained their brilliancy as they rolled down the mountain side until lost to sight behind the intervening range of hills.

These phenomena took place at intervals of about 8 minutes for a period of some 2 hours, and to the writer it appeared as though he were looking at a titanic slag pot being filled by molten slag in some smelter. The glow over the rim gradually increased in intensity until the pot's rim was brilliantly marked by the appearance of slag itself. Finally, the slag spills over the lip in a vivid red sheet and, as it runs down upon and into the slag dump, it breaks through the crust of older slag and appears against the background as splashes of deep-red molten material.

We watched this re-curring boiling over, as it were, of the crater for a period of two hours, at the end of which the activity seemed to decrease. Concluding that the display for

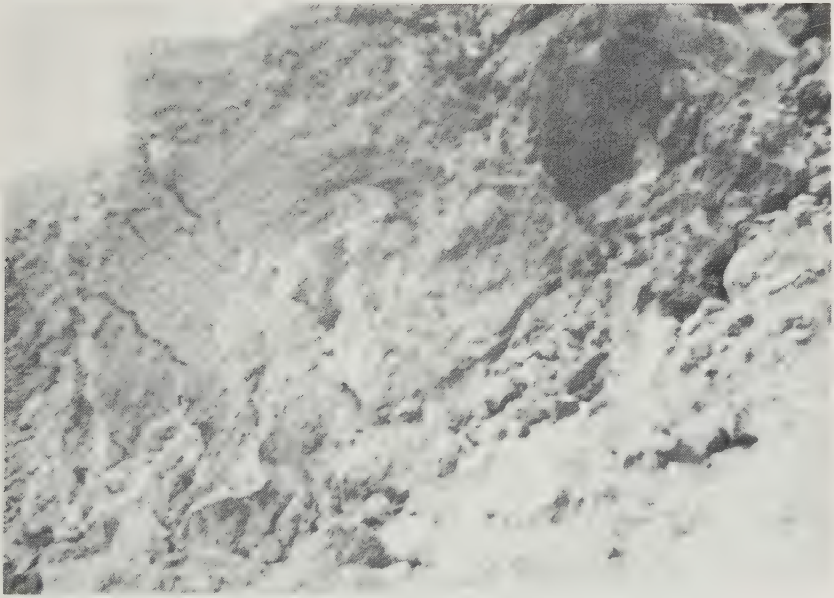

Fig. 47. New lava flow on west side of Lassen Peak, as seen from our trail. Notice the flow lines in the once molten, pasty mass of lava.

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[29] "Balls of fire" were large chunks of hardening lava which still glowed as they rolled down the advancing front of the flow.

that evening was nearly at an end, we returned to the power house and made preparations for a trip on the morrow to Manzanita Lake, which lies almost at the foot of the mountain.

Not very long after the great eruption of 1915, Otto Albers and I were on top of Lassen Peak as before stated, I got down into one of those deep crevices as seen in fig. 19, and got a picture of the rocky walls on either side (Fig. 50). Steam was coming out in many places around not far from where I stood, making the temperature much warmer than I cared for, although the wind was quite cool when out on top.

Going to the southwest end of the old crater rim, and looking toward the northeast, I took a picture looking toward Mineral Point, where the lookout house used to be (Fig. 51a). Immediately in front of me was a sheer drop of perhaps 20 feet, while the deepest part of the new crater is at the lower left hand corner of the picture. The photograph does not do justice to the real picture that greets the eye from this point. Fig. 19 gives us a much more vivid picture of the crater as it really is.

I believe it was in the month of August, 1919, that a party of young folks climbed to the top of Lassen Peak, and our daughter, Mae Loomis, was with them and took her camera along. She secured two pictures that are of especial merit, and they are reproduced here (Fig. 52).

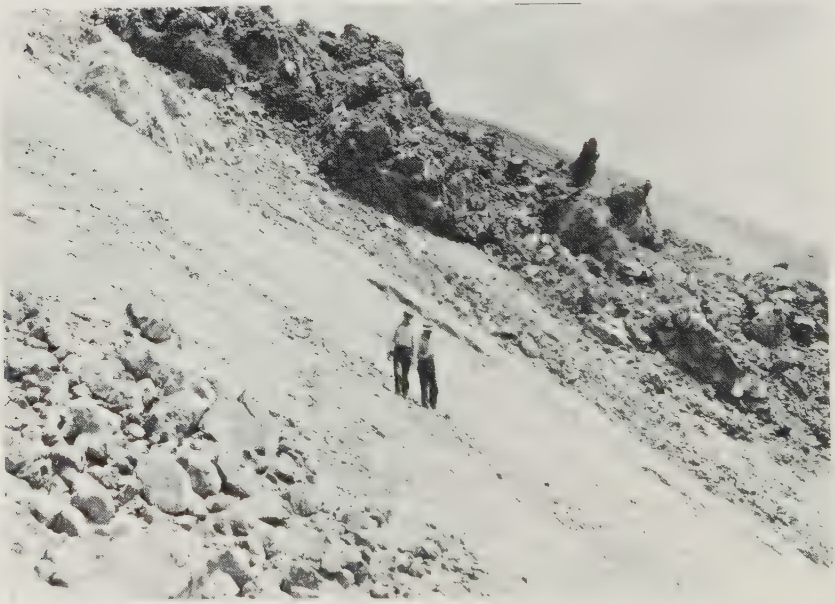

Fig. 48. New lava flow on the west side of Lassen looking south.

One of these is of the North Crater, looking down the north side of Lassen Peak. This crater was especially active after the two great eruptions of May, 1915. It was perfectly quiet when the picture was taken, and has been so ever since. Fig. 43 shows this crater in action. No steam comes from it now that I know of.

Her other picture of note is one of the main crater, which has a pond of water at the bottom of it that is thirty or forty feet across. It follows then that the main crater is sealed up, water tight, and has been so for several years past. Yet even in these days it is commonly reported that Lassen is in eruption, when as a matter of fact, it is not. It is clear that there has not been any explosive eruption since the main crater was sealed up water tight. Then it might be inquired to as how we account for these reported eruptions.

These reported eruptions are accounted for in two ways. If you are at the lakes, or in the devastated area, so you can get a close up view of the peak, it is quite likely that you can see a steam jet every morning, unless there is a strong wind to take the steam away. But in the heat of the day, when the steam cloud is absorbed into the air very quickly, then you will not see any steam at all. But when the air is heavy laden with moisture, so that steam will hold for a long time before it is absorbed into the air, then it is that a light breeze or even wind, will gather

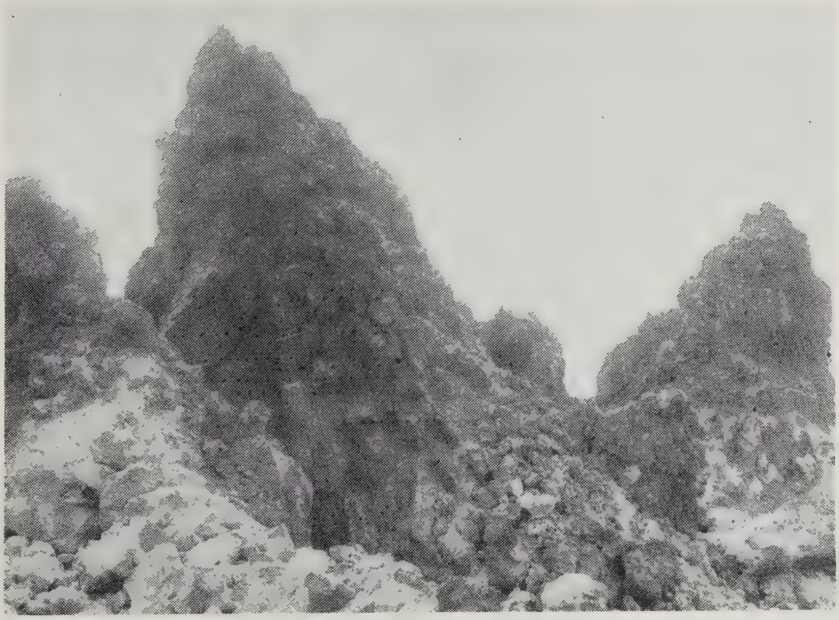

Fig. 49. Pinnacles of new lava at top of new lava flow. Notice the rocks are covered with volcanic ash (lapilli) from later explosive eruptions.

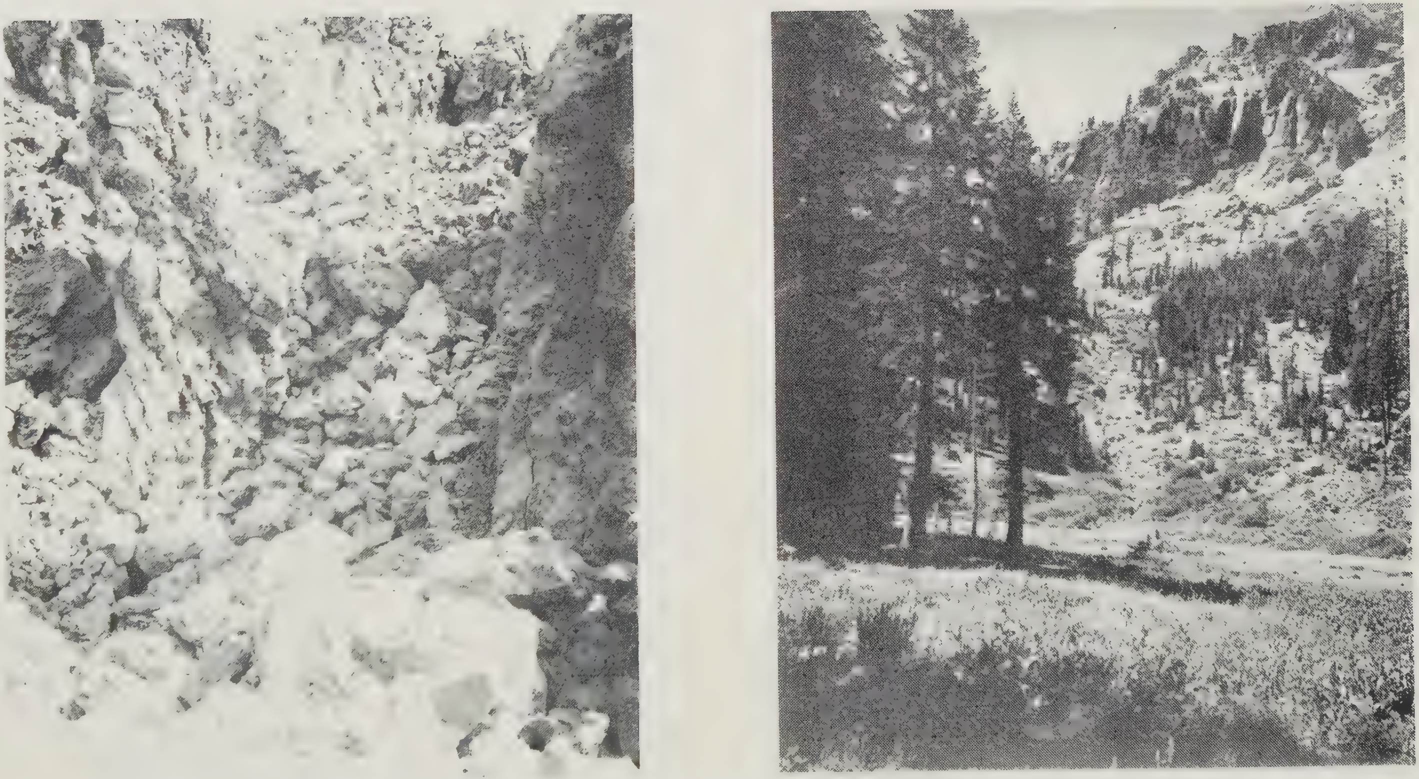

Fig. 50. (a) View from bottom of one of the crevices, shown in fig. 19. Notice Otto Albers above center of picture. (b) West end of Crescent Cliffs, showing moraine and mud flow.

the steam from the several fumaroles, collect it into a cloud, then the next gust of wind sweeping across the summit, takes the steam away in a small cloud. Then they say Lassen is in eruption. The several fumaroles are constant the year around, but there is not the least possible likelihood of Lassen Peak blowing off again for a long time to come.

The other way in which eruptions are reported is when we have a very light snow, then turns off with a heavy north wind, the wind blowing the snow off the peak in small clouds which resembles an eruption very closely.

Occasionally we may see a steam jet blowing off from the top of Lassen Peak as seen in fig. 51b. Usually, though, when there is a heavy steam it goes away in small clouds, yet it may occasionally be seen as it is here.

However, there have been times, and many too, when the volcano seems to be giving off an excessive amount of steam. This may be, and probably is, an eruption. The numerous fumaroles give vent to a considerable amount of steam without in any way disturbing the pond of water at the bottom of the main crater.

Again, the fact that the rocks near the pinnacles are covered with volcanic ash, where it would be washed away with the least amount of rain, is evidence that a small quantity of ash is being blown out right along, and presumably, at those times when the mountain is in eruption, or blowing out an excessive amount of steam. To the best of my knowledge no rocks have been thrown out in any of these recent eruptions, however.

Consequently, so far as safety in visiting the volcano is concerned, I can see no reason why any one should be in danger of visiting the volcano at any time even though one of these so-called eruptions were on at the time of his visit. He might be enveloped in a cloud of moderately warm steam, as I was on June 4, 1914, but it is nothing at all dangerous.

SOURCE OF THE MUD FLOW

We now come to consider the source of the mud flow, and to determine, as nearly as we can, where all of that water came from. As already stated, the local residents here claim that hot water, hot rocks, and maybe steam from the volcano had come down and melted the snow and the whole mass ran down the mountain side taking everything before it. And Wid Hall tells us that a pool of the muddy water was still luke warm in the afternoon of the following day. While, on the other hand, two of the geologists, Dr. Day and Professor Holway, are of the opinion that water, as such, did not come from the crater, except as the

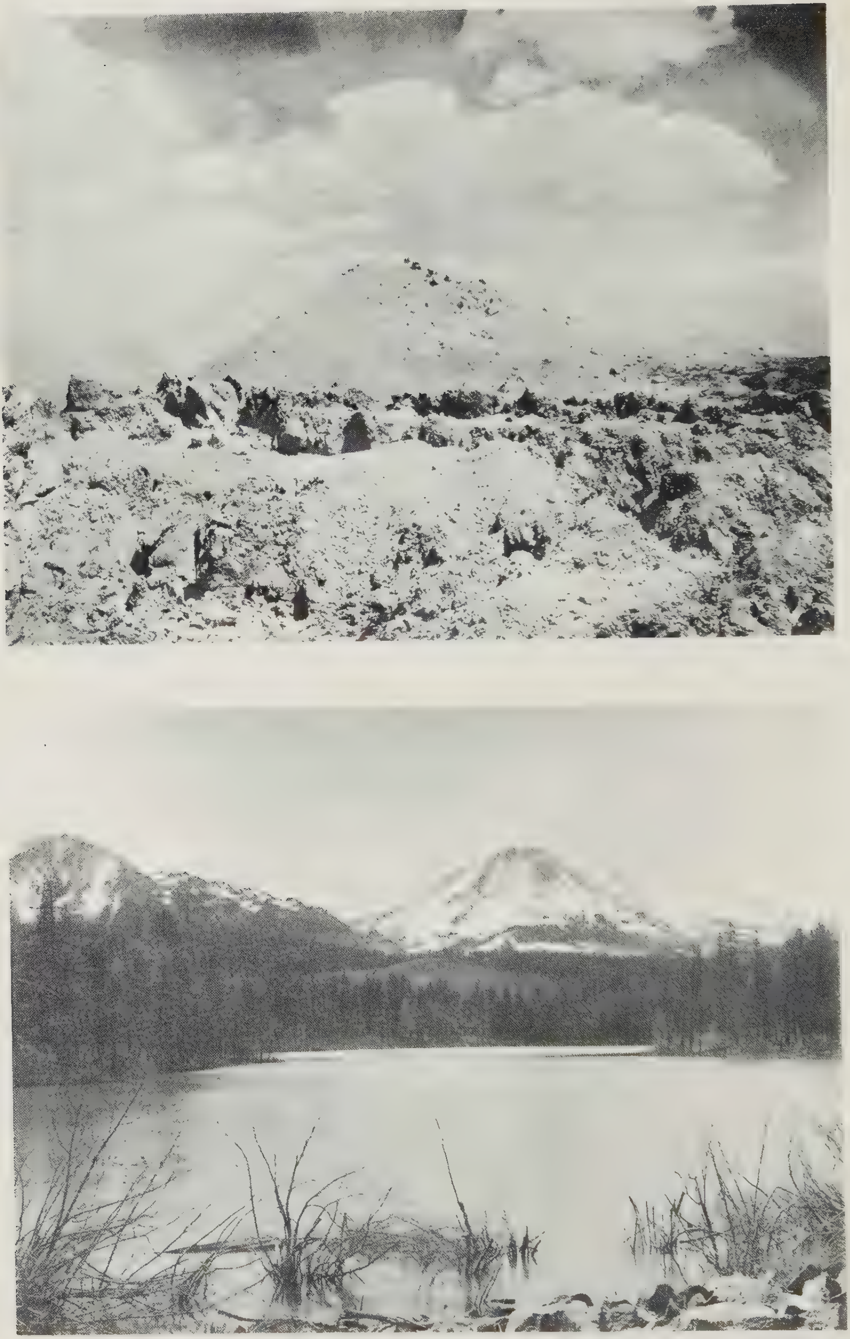

Fig. 51. Top of Lassen Peak, looking NE toward Mineral Point on which the lookout house was built. (b) Lassen Peak, viewed from Manzanita Lake, showing small steam jet. Chaos Crags are at the left.

precipitation of superheated steam; and this, with the hot rocks and a steam jet from the volcano melted the snowdrift, and this was the source of the water supply contained in the mud flow.

It is a foregone conclusion that the whole mass must have gone down the mountain in a gush, or else the mud flow would not have had the momentum to cross over the divide into Hat Creek, for it is a quarter of a mile uphill, and no slow melting of snow, nor any small stream could have carried sufficient momentum to have made the ascent. The marks on the trees, the bark being all battered off and the timber bruised and gashed, indicates that the flood was not only of great depth, being from a few feet up to eighteen feet deep, according to the marks on the trees, but also of great velocity, so that any slow melting of the snow could not have produced the effect which was evidenced there[30].

On May 22, 1915, I made two exposures of Lassen Peak from the same position, at the hot rock; one while the eruption was on (fig. 22) and the other while the eruption was off (fig. 53). The latter had a bad place in the sky, and as the other picture had a nice eruption in it, I naturally made my pictures from the best negative, and discarded the other, or laid it aside as a duplicate. It was only when I began this work that I went through all my old negatives hunting for the first picture I made of the volcano in eruption, when I ran across this one, and noticing that it laid the mountain bare so that the conditions at the top of Lassen Peak could be seen clearly, I found it to be quite a revelation.

The second great eruption occurred on May 22, 1915, just a few hours after this picture was taken. When I went up there again in July with Professor Diller and Dr. Day, Mr. Diller and I climbed to the top of that cliff to the right in this picture, and from there got a close up view of the top of the peak, as seen in fig. 54. A snowdrift is seen to the left in this picture with a small stream of water running along at its base. Dr. Day took a picture at the same time, but he was down on the slope of the mountain and looking so straight up that this outline in his picture does not appear.

We must not believe that the small amount of snow left below the opening of Lassen Peak, nor even any water from the volcano either

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[30] Geologists are generally agreed that the mudflow of May 19th resulted from the following: heat from the lava flow and the hot gases plus rain from the great volume of condensing steam accompanying the eruption melted the unusually heavy snow pack. The resulting volume of water mixed with the mantle of debris from previous explosive eruptions on the slope of the mountain produced all of the mud involved. Water as such has never been reliably observed to have issued from a volcanic vent. Water in the normal liquid state cannot exist in or adjacent to a volcanic crater which is exuding molten lava, as temperatures are so high that all water from the magmatic material or surface waters from the adjacent country rock must at the existing pressures be vaporized as steam.

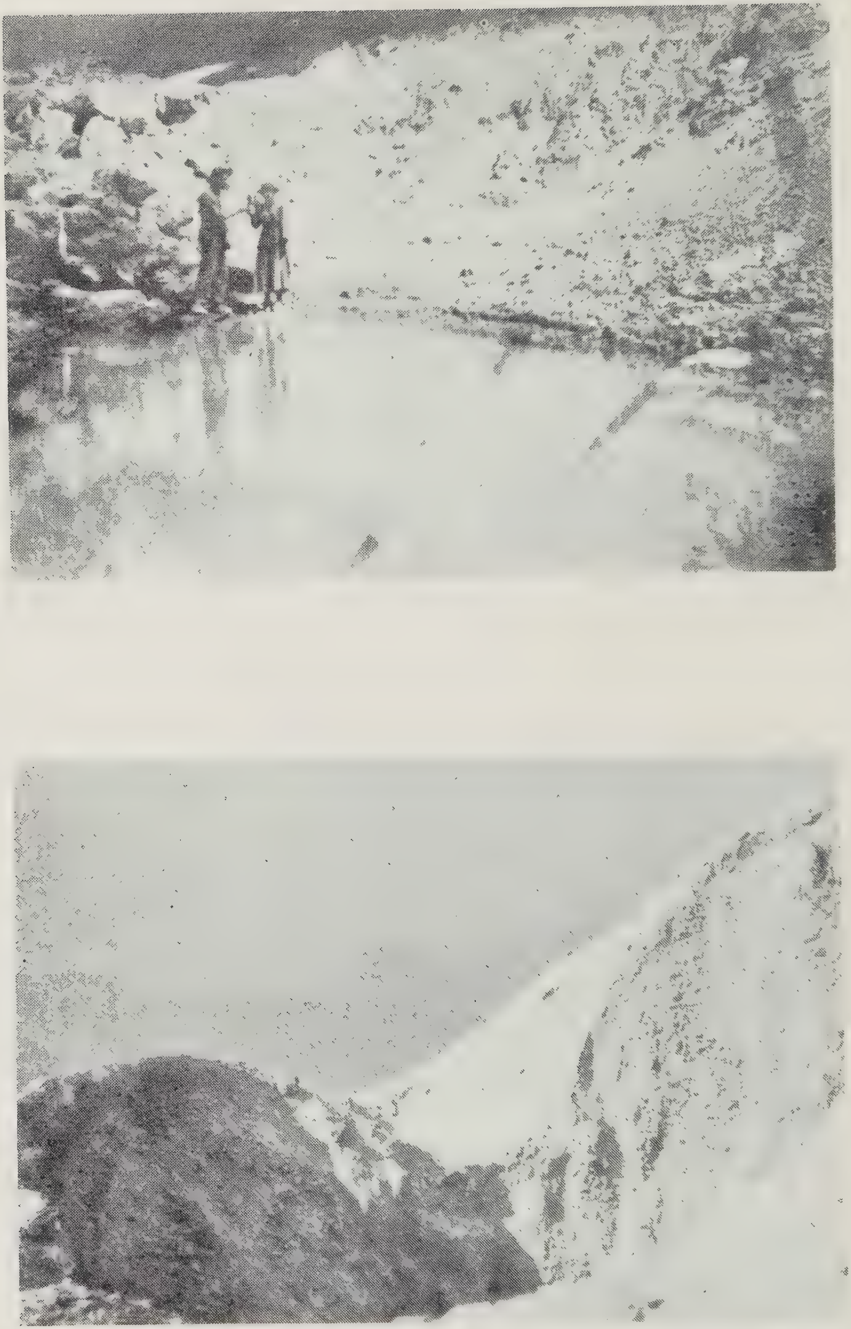


Fig. 52. (a) Pond of water at the bottom of the main crater of Lassen Peak. (b) The North Crater, looking down the side of the Peak toward Manzanita Lake.
Photos Mae Loomis

from water as such, or from the condensation of steam, was sufficient to cause the long drawn out mud flow down Lost Creek on this second eruption. We must recall here the story of Frank Houston. He told us that when his companions crossed Lost Creek on their way up, the creek was only about four inches deep, but after the eruption occurred they stood watching the eruption until they saw the flood coming, then they ran for their team. When they reached the creek at Twin Bridges, the creek was so high they could not cross, and they laid out all night, and the next morning at about nine o'clock they crossed the creek and the water was up to the horses' sides and to the bed of the wagon.

Some joker, is it not? But the reason for it is quite simple. The facts are, in this second great eruption the steam blast was aimed down, and it was this second horizontal blast that blew down all the timber for a space of one and a quarter miles wide, and four miles long.

The explosive period of an eruption never lasted over twenty minutes. They kept on steaming for several hours some times, but that was a case of "steaming after an eruption," as we have two or three illustrations to show. The same may be said of the great eruption. When we reached Viola, a ride of seven miles in an automobile, the force of the

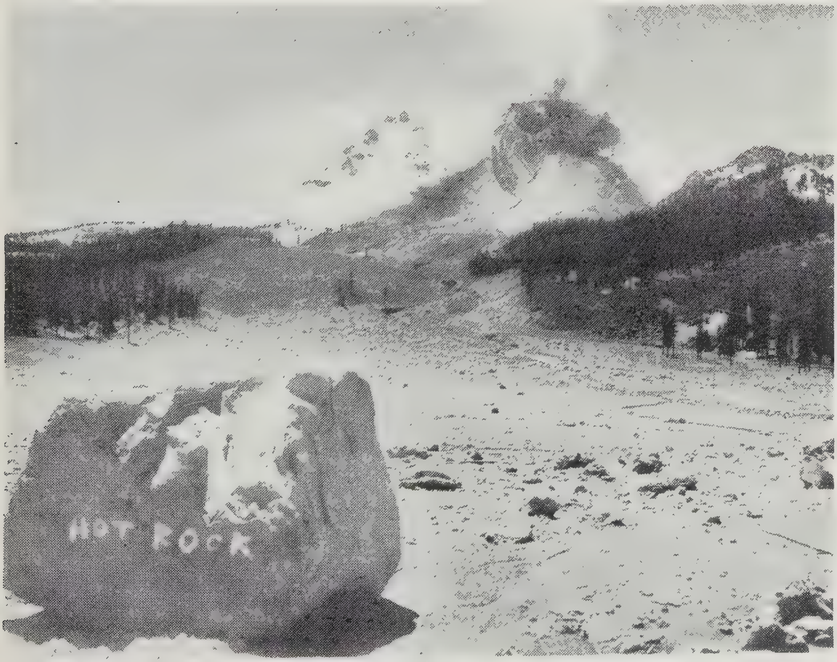


Fig. 53. Lassen Peak from the head of Lost Creek, May 22, 1915
Taken a few hours before the second great eruption.

blast was over, so I did not think it worth while to get a few plates and go back up there to get a picture. It was practically all over.

Thus, I have spoken from a layman's point of view, and it has been my endeavor to give a true and correct account, and to present impartially the views of others bearing upon these subjects. It is not my aim to criticize the views of others, but to present an independent view, and to tell the story as I have seen and understand it. Then the photographs sometimes speak louder than words. The pictures tell a story which words cannot express.

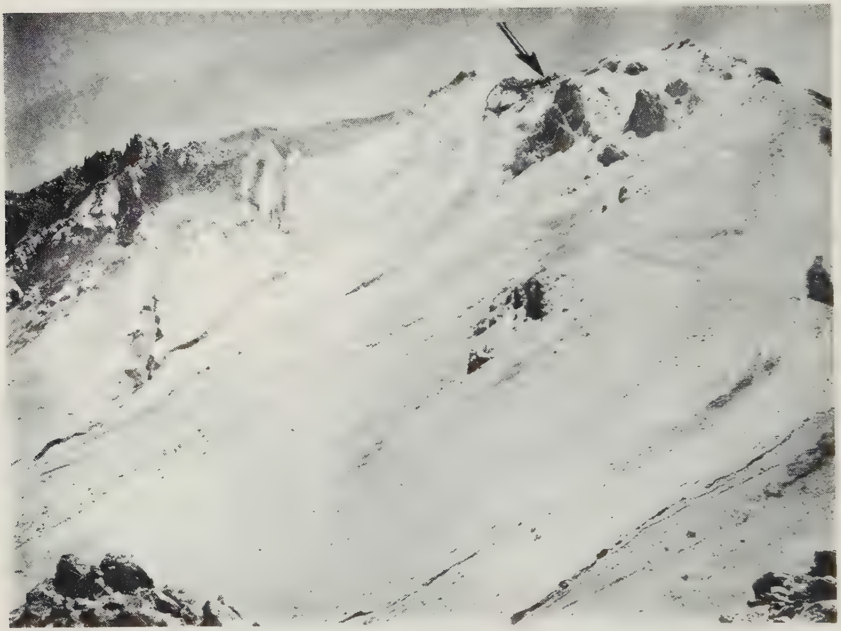
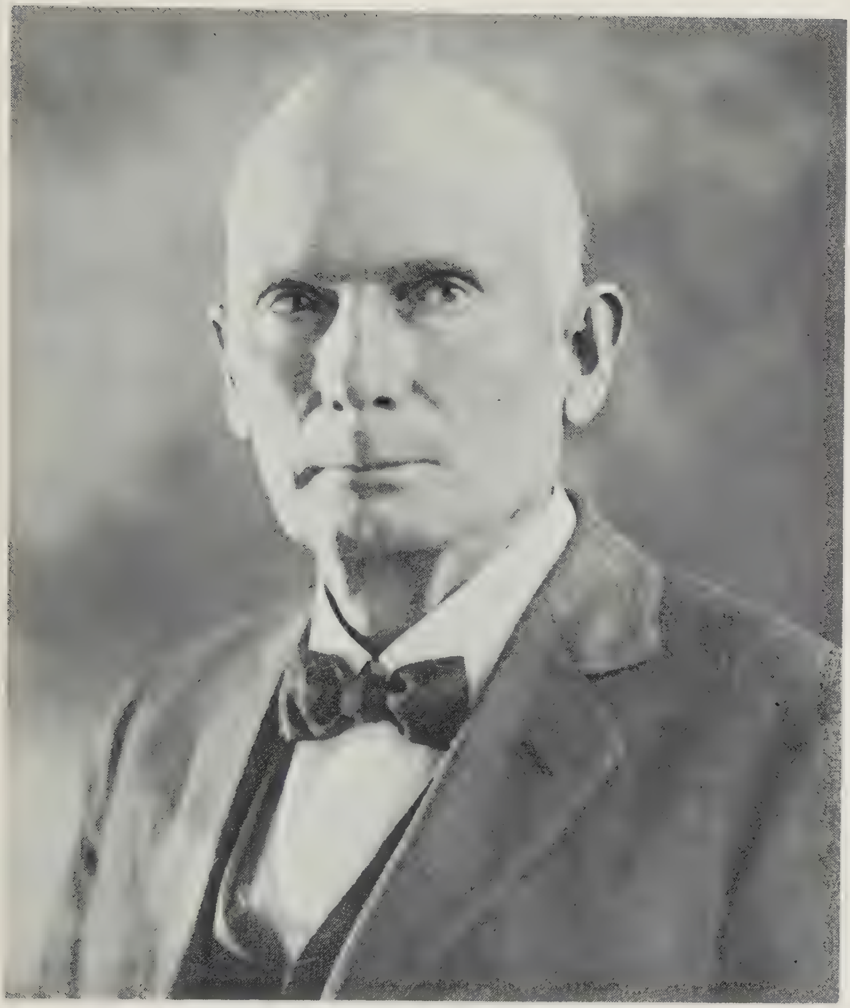


Fig. 54. A closeup view of the east side of Lassen Peak after the floods. Notice the new lava at the top of the Peak (arrow) is black; snowdrift is to the left appearing as vertical white cliff.



Benjamin Franklin Loomis

BIOGRAPHICAL SKETCH OF THE AUTHOR

Benjamin Franklin Loomis was born at Mantaga, Illinois, March 21, 1857. He came to California with his parents in a covered wagon when he was a child. His family lived for several years in Colusa, and later in Red Bluff, California.

In 1874, at the age of 18, he came to Manzanita Lake, and built a small cabin nearby. For the next few years he made shakes in this vicinity during the summers, and worked as a farm laborer in Battle Creek Bottoms during the winters. A few years later he constructed another small cabin on Manzanita Creek along the old Emigrant Road below the Manzanita Chutes, where he continued his occupation as a shake-maker for several years. His long, lonely stay at this place was interrupted in 1886-1887 by a year of study at the American Institute of Phrenology in New York City.

He later homesteaded on the present site of Viola, moving there in 1891. In 1896 he built a store from which he sold supplies to the sawmill workers at Viola. The following year he was married to Estella Loomis, daughter of L. V. Loomis, eminent pioneer resident of Shasta County. During the next few years the Loomis family prospered, as Mr. Loomis spent most of his time hauling freight to Viola and shakes to the Sacramento Valley, and Mrs. Loomis tended the store and postoffice. Later Mr. Loomis bought considerable timberland and a sawmill at Viola, and started logging on a large scale.

He was not too busy to pursue his hobby of photography. Hence, when Lassen Peak began its eruptions in 1914, he was among the first to take pictures and make inspections of these spectacular events. His pictures of the Lassen Peak eruptions are the most complete series in existence. All of them were obtained at the cost of a great deal of time and effort, and some at the risk of life itself, because Mr. Loomis made several trips to the summit of the peak during periods of activity. However, he returned each time with remarkable photographs and much firsthand scientific information.

Mr. Loomis was active in arousing public sentiment, which resulted in the creation of Lassen Volcanic National Park in 1916; and he was thereafter a tireless worker toward its development. His eruption photographs became so famous that after the death on January 13, 1920 of their only child, Louisa Mae Loomis, Mr. and Mrs. Loomis built the Mae Loomis Memorial Museum and dedicated it on July 4, 1927 as a memorial to their daughter and a place to house the valuable photographic record of the eruptions of Lassen Peak. It and the surrounding forty acres of land were deeded to the park as a gift in 1929, and the museum now stands as a fitting monument to the generosity and untiring efforts of Mr. and Mrs. Loomis in behalf of Lassen Volcanic National Park.

Mr. Loomis then retired from business at Viola, and established a residence and art shop near the museum, where he and Mrs. Loomis lived during the summer, selling photographs of the eruptions and views of other natural phenomena of the park. Mr. Loomis passed away June 11, 1935 at the age of seventy-eight. Mrs. Loomis died December 27, 1953. Mr. and Mrs. Loomis and Louisa Mae are buried in the Ogburn Cemetery west of Shingletown, California.

Statement by Dr. Howell Williams:

What was the cause of the mud flows of May 19? Day attributes them to the melting of snow by a downward blast of steam, by rain, and hot ashes. Loomis and Finch, however, deny the occurrence of a hot blast on May 19. Moreover, Finch asserts, from experience of the pisolitic mud rains that attended the eruptions of Kilauea in 1924, that had there been a heavy fall of rain on May 19 it would probably have been little warmer than ordinary rain. Besides, the melting of the superficial snow either by rain or by hot ashes might not precipitate an avalanche and mud flow, for the underlying snow would absorb the water like a sponge and thus prevent any run-off. Finch therefore puts forward an alternative hypothesis. (Finch, R.H., Volcano Letter, Nos 224 and 266, April, 1929 and Jan. 30, 1930). From a careful study of a photograph, not available to Day when he wrote, taken by Loomis on the afternoon of May 22, a few hours before the second great mud flow, Finch is convinced that a long stream of lava had poured through the northeastern notch in the crater rim just as it did through the western notch. "The lava flow could easily have melted the snow down to the ground and have sent a stream of warm water under the snow lower down the slope. An avalanche mixed with hot rock could have been started in this way and might have produced a flood of the magnitude observed." When the horizontal blast of May 22 occurred the tongue of lava was torn away so that now only its roots are to be seen . . . The course of this blast, as already noted, was approximately along the course of the earlier mud flow, but its swath was wider with the result that much fresh snow was melted and minor mud flows resulted. It will be seen from the foregoing that Finch admits the origin of the later mud flows, both those that descended Hat and Lost Creeks and those of the north and west flanks of the volcano, to be the melting of snow by steam, rain, and ashes, but that he assigns the great mud flow of May 19 to the influence of a lava flow the occurrence of which is not admitted by Day. In support of Finch's conception, it should be stated that the amount of black lava detritus in the mud-flow deposits of Hat and Lost Creeks is exceedingly large, and that if it were replaced inside the present crater of Lassen Peak, on top of the black lava which now fills it to the brim, it would form a dome of large proportions. But since no observer witnessed such a

> dome of lava on the summit of the mountain, there is only one other possible place from which the detritus could have come, namely from a lava tongue such as Finch has postulated. Coupling this evidence with the Loomis photograph the case for a northeast lava flow seems almost proved.

In the foregoing quotation, the photograph Dr. Williams refers to in his treatise "Geology of Lassen Volcanic National Park, California," University of California Publications, Bulletin of the Department of Geological Sciences, Vol 21, No. 8, 1932, is the one in which Mr. Loomis saw later what he thought might be a "hole" in the side of the mountain. This is Fig. 53 in the text.

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